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YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

The Nevada Railroad System: Physical, Operational, and Accident Characteristics

SEPTEMBER 1991

UNITED STATES DEPARTMENT OF ENERGY

THE NEVADA RAILROAD SYSTEM: PHYSICAL, OPERATIONAL, AND ACCIDENT CHARACTERISTICS

Prepared by:

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GLOSSARY

> **Note:** *The reader is encouraged to read Appendix A, Railroad Technology, and to refer to this glossary for an understanding of railroad terminology and for information on the operational and physical characteristics of railroads.*

Association of American Railroads Plate F - A set of design criteria governing the maximum dimensions of freight cars that may be freely interchanged from one rail line to another. The criteria were established by the Association of American Railroads (AAR), an industry trade group.

at-grade crossing - A structure that allows one track to cross another track or a highway at the same elevation.

ballast - Selected material placed on the roadbed for the purpose of holding the track in line and surface.

body bolster - The major transverse load-carrying member of a carbody structure which serves to transmit loads of side sills to the truck center plates.

branchline - The secondary line or lines of a railway.

bumping post - A structure placed at the end of a track where equipment must come to an absolute stop to prevent injury or damage to pedestrians, permanent structures, cars, etc.

center pin - A large bolt which passes through the center plates on the body bolster and truck bolster. The truck turns about the bolt, but the stress is taken by the center plates.

center plate - One of a pair of plates which fits one into the other and which support the car body on the trucks, allowing the pair of plates to turn freely under the car.

consist - A railroad term for any configuration of one or more connected rail cars and/or locomotives, either in motion or not, on rail tracks. A consist may or may not include a locomotive.

coupler - A device located at both ends of all cars and locomotives in a standard location to provide a means for connecting one rail vehicle to another. The standard coupler uses a pivoting knuckle and an internal mechanism that automatically locks when the knuckle is pushed closed, either manually or by a mating coupler. A manual operation is necessary to uncouple two cars whose couplers are locked together.

crib - The space between two adjacent ties.

double stack car, twin stack car - A type of rail car designed for efficiently moving large volumes of containerized cargo. The design often consists of a number of articulated cars in which consecutive lightweight platforms are supported by a connecting truck assembly. Containers are stacked two high on the platforms and are approximately 20 feet high.

draft system - The term used to describe the arrangement on a car for transmitting coupler forces to the center sill. On standard draft gear cars, the draft system includes the coupler, yoke, draft gear, follower, draft key, draft lugs, and draft sill.

dragging equipment detector - A track device which detects the passage of train wheels that are not properly mated to the rails. Other commonly used detectors include hot journal detectors, clearance detectors, high water detectors, and slide detectors.

frog - A track structure used at the intersection of two running rails to provide support for wheels, and passageways for their flanges, thus permitting wheels on either rail to cross the other.

gauge - In railroad terms, the distance between the inside edges of the tops of the track. In North America, gauge is standardized at 4 feet 8 1/2 inches.

grade-separated crossing - A structure or set of structures allowing two tracks, or one or more tracks and a highway, to cross each other at different elevations.

hot journal detector, hot box detector - A track device which measures the relative temperatures of passing journal bearings. Hot journal detectors transmit bearing temperatures to wayside stations, where the information is monitored by personnel who can act to stop a train if an overheated journal is discovered. Some detectors will automatically drop the next signal to a stop indication if an overheated condition is noted.

hub - The central portion of a wheel into which the axle is fitted.

joint bar - A steel member, embodying beam-strength and stiffness in its structural shape and material. Joint bars are commonly used in pairs to join rail ends together, and to hold rail ends accurately, evenly, and firmly in position with reference to surface and gauge-side alignment.

journal - The part of an axle or shaft on which the journal bearing rests.

journal bearing - A combination of rollers and braces or a block of metal, usually brass or bronze, in contact with the end of the axle and on which the load rests. In car construction, the term (when unqualified) means a car axle journal bearing.

locomotive - A self-propelled, non-revenue rail vehicle designed to convert electrical or mechanical energy into tractive effort to haul railway cars.

manway - An opening in the dome of a tank car which permits access to the car's interior for such purposes as cleaning, inspecting, and making repairs. Also known as a "manhole."

mainline - The principal line or lines of a railway.

paired track - Two rail lines running roughly parallel, but which are operated as one route. Generally, one track is devoted to traffic moving in one direction, while the other track is devoted to traffic moving in the opposite direction.

passing sidings - Track structures placed at intervals on a rail line and consisting of switches and a section of parallel track to allow for passing movements (either overtaking or oncoming) of different trains.

shortline - A railroad line operated over a relatively short distance. Generally, a shortline is not a through route, but a route that connects a mainline or branchline with an area requiring service.

side bearing - Bearings attached to the bolsters of a car body, or truck, on each side of the center plate to prevent excessive rocking. The upper, or body side bearing, and the lower, or truck side bearing, are sometimes merely large flat surfaces. Other types of side bearings employ rollers, springs, and friction elements to maintain constant contact and to control relative movement between the body and the truck.

switch - A track structure with movable rails to divert rolling stock from one track to another.

tie, crosstie - The transverse member of the track structure to which the rails are spiked or otherwise fastened to provide proper gauge. Crossties cushion, distribute, and transmit the stresses of traffic through the ballast to the roadbed.

trackage rights - An agreement between two or more railroad companies allowing one company to operate trains on certain of the other company's tracks.

truck - The assembly of parts comprising the structures which support a car body at each end and also provide for attachment of wheels and axles. In the case of articulated cars, the joint support of two abutting car ends.

truck bolster - The transverse load-carrying member of the truck which receives, through the center plate, the weight of the car or locomotive body. The truck bolster transmits this weight to the truck frame (usually through the suspension).

unit train - A train transporting a single commodity from one source (shipper) to one destination (consignee) in accordance with an applicable tariff and with assigned cars.

wheel flange - The tapered projection extending completely around the inner rim of a railway wheel. The wheel flange, in conjunction with the flange of a mate wheel, keeps the wheel set on the track by limiting lateral movement of the truck assembly against the inside surface of either rail.

yard - A railroad location comprised of tracks, switches, and other structures. Yards are used for train composition, car storage, and other purposes.

EXECUTIVE SUMMARY

This report provides a description of the operational and physical characteristics of the Nevada railroad system. To understand the dynamics of the rail system, one must consider the system's physical characteristics, routing, uses, interactions with other systems, and unique operational characteristics, if any.

This report is presented in two parts. The first part is a narrative description of all mainlines and major branchlines of the Nevada railroad system. Each Nevada rail route is described, including the route's physical characteristics, traffic type and volume, track conditions, and history. The second part of this study provides a more detailed analysis of Nevada railroad accident characteristics than was presented in the <u>Preliminary Nevada Transportation Accident Characterization Study</u> (DOE, 1990).

In 1988, Class I railroads operated 1,440 route miles of track in Nevada, including trackage rights. This accounted for slightly over one percent of the total 139,856 U.S. route miles. Railroading does not appear to be a major employer in the state. As of March 12, 1989, the Class I carriers employed 823 Nevada residents and 258,023 persons nationwide.

Nevada has three main line routes, one owned by the Southern Pacific Transportation Company (SP) and two owned by the Union Pacific Railroad (UP). Nevada's only remaining shortline railroad, the Nevada Northern, is currently inactive.

The SP operates over portions of two through routes: (1) the Overland Route serving Reno/Sparks, Winnemucca, Battle Mountain, and Elko; and (2) the Modoc Line running from Flanigan, through northern California to Klamath Falls, Oregon. Trackage rights over the UP Feather River Line between Flanigan and Weso, Nevada, link the Modoc Line with the Overland Route. There are two remaining SP branches in Nevada. Both leave the Overland Route at Hazen. One extends to Fallon and the other to a point near the town of Hawthorne.

The UP owns the Los Angeles and Salt Lake (LA&SL) Line and the Feather River Line. The LA&SL Line extends from Salt Lake City, Utah, passes through the city of Las Vegas and connects with another railroad line in southern California. Short branches extend to various industries. The Feather River Line is the former Western Pacific Railway (WP) route; it runs parallel to the SP Overland Route through northern Nevada. A short branch extends to Reno.

The City of Los Angeles Department of Water and Power (DWP) owns the former Nevada Northern railway, which extends northward from Ely to connect with the UP at Shafter and the SP at Cobre. Although not officially abandoned, this line has not been operated since 1983, when the copper industry around Ely shut down. The line is mothballed pending the nearby construction of a DWP generating station, which will receive trainloads of coal.

The railroad system in Nevada is today in excellent physical condition, with only a few miles of branchline rails in less than excellent condition. Remaining rail lines in the state comprise a core system, and the obvious opportunities for further network reduction are limited to the few remaining branches.

One of the initial goals of this study was to identify high accident locations and provide information on "high-profile" accidents that have occurred on the Nevada rail system. For accidents strictly involving rail equipment, the analysis showed that there are no classical "high accident" locations as there are with highway transport. Instead, minor accidents tended to occur in yards and during

switching operations. More severe accidents, occurring at higher speeds on open track, seemed to happen at random.

Rail-highway crossings typically represent a locus of rail accidents. Nationally, rail-highway crossing accidents are by far the most likely type of accident to occur in rail operations, comprising 61.4 percent of all accidents. In Nevada, however, derailments are the most frequent accident type (50.3 percent of all accidents) and rail-highway accidents are second (34.2 percent). Nevada has an active program to monitor rail-highway crossings to identify those crossings that should be prioritized for safety upgrades. This program has been effective enough to have eliminated the only significant problem location identified during the 10-year period under study. Nevertheless, because crossings represent a point of interaction between the rail system and general public, this report examines rail-highway crossing safety in the State.

When rail-highway grade crossings are studied, two points appear significant: (1) the relative importance of this type of accident when compared with all other types, and (2) the dramatic difference between Nevada and the rest of the United States in terms of the relative contribution of rail-highway crossing accidents to the overall accident mix. In evaluating the overall contribution of rail-highway accidents, it is important to remember that this type of accident may be more completely reported to the Federal Railroad Administration (FRA) than other types of accidents.

When the causes of rail accidents are examined, the national and Nevada data differ. During the 10-year period being examined, the two most common causes of rail accidents in Nevada were *mechanical/electrical* and *human factors*, which caused 39.4 percent and 30.3 percent, respectively, of the total accidents. The other approximate one-third of the accidents were divided between *miscellaneous* (14.4 percent) and *track/roadbed* (15.9 percent). This indicates that the most likely cause of a train accident in Nevada will be either a mechanical failure of some part of the train itself, or a problem due to improper operation of the train. In contrast, nationwide data show that 38.9 percent of all accidents are attributed to *track/roadbed*. *Human factors* is still second with 28.5 percent of all accidents, while *mechanical/electrical* is third, causing 17.0 percent of all accidents. *Miscellaneous* is the least common cause — 15.6 percent of all accidents. In Nevada, mechanical/electrical causes are cited twice as often as the cause of accidents compared with the other 49 states. These numbers were derived using the Accident/Incident Data Base, which strongly underreports rail-highway grade crossing accidents. Under the FRA's cause classification scheme, rail-highway grade crossing accidents are listed as an accident cause (the reason for this becomes apparent when one considers the difficulty of identifying the cause of such an accident and the legal issues associated with such an identification).

Attempts to identify high accident locations in Nevada were only partially successful. Analysis of accident locations showed that 62 accidents happened on yard tracks (20.5 percent of all reported Nevada rail accidents) in 13 locations. Furthermore, when the accidents that occurred on mainlines, sidings, and industrial spurs in these 13 locations are considered, an additional 87 accidents are included, bringing the total number of accidents for these locations to 149 (accounting for 49.2 percent of all rail accidents in Nevada). The other 154 reported accidents are widely distributed among 87 sites.

PART 1
THE NEVADA RAILROAD SYSTEM

1 INTRODUCTION

Part 1 of this report describes Nevada's railroad system, including the system's history, physical characteristics, and operational characteristics. Appendix A briefly describes railroad terms that are used in the following discussion. Part 2 examines accidents that have occurred on the Nevada railroad system and, wherever feasible, presents comparisons to the national system.

Overview of Nevada Railroads

In 1988, Class I railroads operated 1,440 route miles of track in Nevada, including trackage rights. This accounted for slightly over one percent of the total 139,856 U.S. route miles. Railroading does not appear to be a major employer in the state. As of March 12, 1989, the Class I carriers employed 823 Nevada residents out of a total of 258,023 railworkers nationwide. Figure 1 shows the Nevada rail network.

Although Nevada has a small portion of the nation's rail mileage, the routes operating through the state are important. Nevada has three mainline routes, one owned by the Southern Pacific Transportation Company (SP) and two owned by the Union Pacific Railroad (UP). Nevada's only remaining shortline railroad, the Nevada Northern, is currently inactive.

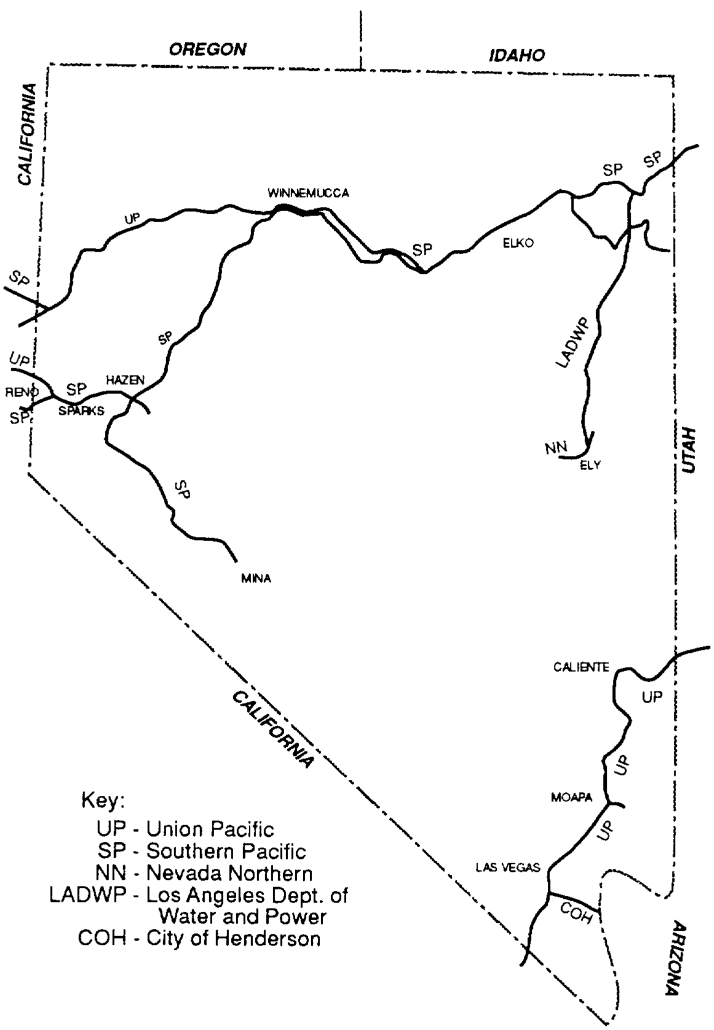

Figure 1 — Existing Nevada Rail System

The SP operates over portions of two through routes: (1) the Overland Route serving Reno/Sparks, Winnemucca, Battle Mountain, and Elko, and (2) the Modoc Line running from Flanigan, Nevada, through northern California to Klamath Falls, Oregon. Trackage rights over the UP Feather River Line between Flanigan and Weso, Nevada, link the Modoc Line with the Overland Route. There are two remaining SP branches in Nevada. Both leave the Overland Route at Hazen. One extends to Fallon and the other to a point near the town of Hawthorne.

The UP owns the Los Angeles and Salt Lake (LA&SL) Line and the Feather River Line. The LA&SL Line serves Las Vegas and runs from Salt Lake City, Utah, to southern California where it connects to the Atchison, Topeka, and Santa Fe line. Short branches extend to various industries. The former Western Pacific Railway route runs parallel to the SP Overland Route through northern Nevada. A short branch extends to Reno.

The City of Los Angeles Department of Water and Power (LADWP) owns the former Nevada Northern railway, which extends northward from Ely to connect with the UP at Shafter and the SP at Cobre. Although not officially abandoned, this line has not been operated since 1983, when the copper industry around Ely shut down. The line is mothballed pending the nearby construction of a generating station, which will receive trainloads of coal.

The remaining sections in Part 1 describe these routes in greater detail. The historical information is a compilation of data from Myricle (1963), SNDT (1987), and Sigmon (1988). Appendix B provides graphic profiles showing all major features and elevations of the three mainlines and the major branchlines in Nevada.

2 UNION PACIFIC RAILROAD - FEATHER RIVER LINE

The UP Feather River Line extends 928 miles between Oakland, California, and Salt Lake City, Utah. This track was the former Western Pacific Railway (WP). About 427 miles of track cross northern Nevada, extending in a roughly west-east direction between Herlong, California, and Wendover, Utah. A short branch extends from the mainline at Reno Junction, California, to serve Reno, where a connection is made with the SP Overland Route mainline. Twenty-two miles of the Reno Branch lie in Nevada. Figure 2 shows the Feather River Line's Nevada track.

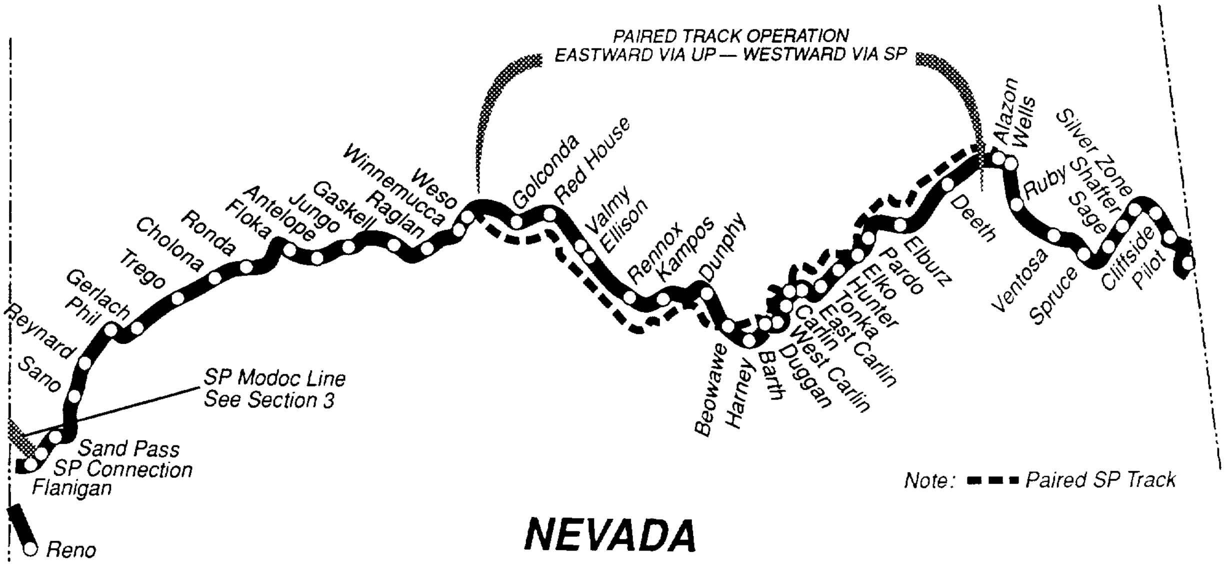

Figure 2 — Union Pacific Feather River Line and Reno Branch

Mainline

From a minor regional railroad, the Feather River Line has become an important arm of a major transcontinental carrier. The UP has invested capital and brought new traffic to the route. Traffic that formerly interchanged between the UP and SP at Ogden, Utah, now travels via the Feather River Line. The route is an important corridor for double stack trains between the Port of Oakland and the midwest. The UP has made needed improvements in the track structure, such as new ballast, ties, welded rail, and alignment changes, to handle this traffic.

<u>History</u>

The WP was incorporated on March 6, 1903, to run between Oakland, California and Salt Lake City, Utah. Its purpose was to provide an alternative transcontinental rail link between Salt Lake City and the San Francisco Bay area. At the time, rail traffic in this corridor was dominated by the UP and SP, both controlled by railroad baron E. H. Harriman. This joint domination dated back to the completion of the first transcontinental rail line by the two railroads in 1869. Under Harriman's control, however, many felt that the combined railroads had a stranglehold on western rail traffic.

The new WP was backed by a wealth of supporters, and George Gould was the driving influence. Gould, a railroad magnate, hoped to garner a share of the UP/SP traffic. In conjunction with two of his other railroads, the Denver and Rio Grande Western and the Missouri Pacific, the WP could be part of a through line between the Mississippi River and the Bay Area.

To protect the interest of the investors by reducing operating costs, mortgage documents required that the railroad mainline have no grade exceeding one percent. To further ensure that management focused on completing the vital mainline, the mortgage also stipulated that no branch lines could be added. The consequences of these provisions haunted the company for many years to come.

Several routes were initially surveyed. The final route traversed northern Nevada and followed the Feather River Canyon into central California. The line crossed the Sierra Nevadas at a point almost 1,700 feet lower than the rival SP (5,220 feet vs. 6,900 feet) and with considerably less gradient, but with an additional 180 miles. Within Nevada, 180 miles of the WP paralleled the rival SP along the Humboldt River.

Work began on both ends of the line in early 1906. Rail from Salt Lake City reached the Nevada state line on May 14, 1907. Clearing the grade was slow. To keep true to the one percent grade limit, 43 tunnels had to be blasted through the hills. One such tunnel was the Spring Garden, which is over 7,000 feet from portal to portal. Although the low grade would later reduce operating costs, these tunnels were extremely costly to build and the young railroad was saddled with debt. Despite the hardships, track was completed to Elko by Christmas 1908. Finally on November 1, 1909, the last spike was driven at Spanish Creek Bridge in California.

The mortgage stipulation which prohibited the construction of branches limited the local traffic available to the WP. The Nevada countryside that the WP traversed was essentially desert, devoid of population. Because the rich, well-established SP was under no branch limitations, it had already attracted whatever local traffic was available in the area. Consequently, the WP was essentially dependent upon through traffic. Unfortunately, the Rio Grande connection to the east had a rugged Rocky Mountain crossing, and the two railroads struggled to maintain rates competitive with the rival SP/UP team. The combination of low traffic and high construction debt made the WP financially unsuccessful and it went into receivership in 1915. A renegotiation of the mortgage resulted, and new branches, as well as acquisitions, allowed extension of the line, including a much-needed branch to Reno.

During World War I, the Federal government assumed control of the nation's railroads. Under government operation, the WP and SP lines along the Humboldt River became paired track, with all eastbound travel using WP rails and westbound movements using the SP. Following the war, the two railroads went back to their original operations for a time. After considering the profitable benefits, however, the companies agreed in 1924 to resume paired operation, and the arrangement continues today.

Despite a valiant effort, the WP could not maintain its financial health under the pressures of SP/UP competition and the Great Depression. The company again entered receivership in 1935, where it remained until 1945. Greatly increased traffic resulting from World War II and the Korean conflict financed needed improvements, such as new rail and the installation of Centralized Track Control (CTC) on the mainline.

By the late 1970s, the WP was again experiencing cash flow problems. Traffic was reduced to 2-3 daily trains each way between California and Salt Lake City. The railroad was unable to generate sufficient cash to make needed improvements. Accordingly, the management agreed on January 28, 1980, to sell the railroad to the UP. The WP was officially merged into the UP on December 22, 1982.

Route Description

The following narrative characterizes the Feather River Line within Nevada. The description proceeds from west to east in order of increasing mileposts.

The line in Nevada begins as the Winnemucca Subdivision of the UP's Feather River Division. Traveling east, the Winnemucca Sub enters Nevada in the Honey Lake Valley just west of Herlong, California, at milepost (MP) 378.3. At this point, the line is essentially flat and straight. Just east of Flanigan (MP 384.4) is the junction with the SP Modoc Line to Klamath Falls, Oregon. SP has trackage rights on the UP between Flanigan and Weso, 151 miles to the east.

From Flanigan, the line begins a 0.4 percent climb through the Terraced Hills, cresting at Sand Pass (MP 393.7), the entrance to the Smoke Creek Desert. The descent from Sand Pass to the desert floor takes place on grades of up to 1.0 percent. The territory through the pass has numerous curves which restrict speeds to 35 mph. Once on the desert floor, however, the railroad heads 26 miles to the northeast with minimal curvature and gradient. Allowable train speed increases to 70 mph.

East of Phil (MP 430.8), the line bends sharply to the southeast to pass between the Fox and Granite Ranges to enter the Black Rock Desert. Just west of Gerlach (MP 437.9), the railroad again resumes its northeasterly course.

Gerlach is the only inhabited town in Nevada on the Feather River Line west of Winnemucca. Here, the UP interchanges with the U.S. Gypsum Railroad, a private carrier that operates six miles of track between a wallboard plant at Empire and the UP mainline.

From Gerlach, the line runs east for 37 miles with minimal gradient and curvature. At MP 475, the line begins a 0.8 percent climb to Antelope Pass (MP 487.6). The descending grade through the pass, which takes the railroad between the Antelope and Jackson Ranges, is 1 percent. Jungo (MP 496.6) is the foot of the eastbound descent. From Jungo, the rails proceed on a level course east across Desert Valley. Near Raglan (MP 519.2), the line comes into the proximity of the Humboldt River. For the next 180 miles, the railroad parallels this river and its tributaries across Nevada. East from Raglan, the railroad passes through Winnemucca (MP 531.1), the first population center since Gerlach (MP 437.9). Winnemucca is the site of a small freight yard.

At Weso (MP 535.7), just east of Winnemucca, the UP makes a connection with the SP mainline. Between Weso and Alazon (MP 713.6), the two railroads operate joint trackage. The segment essentially functions as double track with eastbound trains of both companies normally using UP rails and westbounds using the SP line. The lines are block signalled only for the direction of traffic, and reverse movements are rare. Although the railroads are roughly parallel, their rights-of-way often diverge for several miles. The UP line is slightly shorter than the SP line (178.2 miles versus 183.0 miles). Crossovers to allow detour movements are located at points where the lines are in proximity.

Beyond Weso, the UP and SP follow the Humboldt River Valley. The UP line is initially on the north side of the river. The alignment ascends slightly, but overall the profile is very gentle. Valmy (MP 572.2) is the site of Sierra Pacific Power's North Valmy generating station, which receives coal shipments from Utah via the railroad.

Just east of Barth (MP 630.5), the Humboldt River flows through the narrow Palisade Canyon. The two railroads are forced close together, and the two lines switch sides of the river. In the next 20 miles, the railroad passes through four short tunnels necessitated by the canyon walls. The curves in the canyon limit train speeds to 45 mph.

Carlin (MP 644.6) is a point for SP crew changes. Elko (MP 669.2), the next major town on the line, is the change point for UP crews and the site of a small freight yard. UP crews operate eastward from Elko to Salt Lake City, and westward to Portola, California. Elko marks the end of the Winnemucca Subdivision and the beginning of the Lake Subdivision.

From Elko the rails proceed east toward Alazon, where joint operations end. Alazon also marks the beginning of Utah Division trackage. The eastbound gradient increases to 0.4 percent in spots as the line begins to climb out of the Humboldt River Valley. Wells (MP 717.7), just east of Alazon, is the last town in Nevada through which the UP passes. The UP's Wells Branch once extended 123.4 miles north from this point to the UP mainline at Twin Falls, Idaho.

From Ruby, the line strikes due south through Independence Valley toward an assault on the Peoquop Mountains. Spruce (MP 747.2) marks the beginning of five miles of 1.0 percent ascending grade to the Peoquop summit. The climax of this grade is Hogan's Tunnel, 5,676 feet long. At 5,901 feet above sea level, the west portal of this tunnel represents the highest elevation on the entire Feather River Line. The rails descend east through five more miles of 1 percent grade into Goshute Valley.

Shafter (MP 766.4) was located at the crossing of the UP and the now inactive Nevada Northern Railroad (NN). The NN line extended from a copper mining area around Ely to connections with the UP and SP. The closing of the smelter in 1983 removed the major traffic source on the NN, but construction of a coal-fired power plant on the line will require the line to be reopened in the late 1990s. The UP removed the NN crossing from its mainline in 1986.

Just east of Shafter, the line again begins a 1 percent climb to the summit of the Taono Range at Silver Zone (MP 772.4). Cresting Silver Zone Pass, eastbound trains begin 33 miles of descent at a 1.0 percent grade, ending at Wendover (MP 806.6). Rails cross the Utah state line at MP 805.6, one mile west of Wendover.

Physical Plant

Under UP ownership, the Feather River Line in Nevada is being developed into a heavy duty railroad. In conjunction with American President Lines, the UP recently completed a campaign to raise tunnel clearances along the route for doublestack trains. The UP has upgraded track by increasing the ballast section and laying heavy welded rail ranging from 119 to 136 pounds per yard.

Currently, the UP maintains the following gross weight restrictions for cars on the Feather River Line, including the Reno Branch:

4-axle cars	—	263,000 lb.
6-axle cars	—	394,000 lb.
8-axle cars	—	526,000 lb.

Specific 4-axle cars of 315,000 lb gross weight can be handled. In summary, the line is cleared for the typical (and desirable) 100-ton payload freight car in use today. The UP has not yet upgraded the line for the next generation 125-ton car. The railroad also allows the largest 6-axle locomotives over all portions of the Feather River Line.

Clearances along the route accommodate cars meeting Association of American Railroads (AAR) Plate F, and are adequate for double stack service for a maximum car height of less than 20'-0".

The alignment of the Feather River Line is generally conducive to high train speeds. The UP's rail improvement program has raised maximum freight train speeds from 60 to 70 miles per hour where signalling, train consist, and alignment permit. Passenger trains are allowed to go up to 79 miles per hour in many locations.

East of Alazon and west of Weso, trains operate on the mainline under a CTC system, with dispatchers located in Sacramento. By late 1991, however, dispatching for the line will be consolidated in the new UP System dispatching center in Omaha, Nebraska. Train crews have direct radio communications with the dispatcher.

The railroad has passing sidings spaced at intervals ranging from 6 to 14.5 miles, with 14 miles being the average spacing on the single track. On the single track, train movement into and out of the sidings is governed by dispatcher-controlled, power-operated turnouts. Passing sidings range from 5,723 to 10,007 feet; the average siding length is 6,338 feet. This is sufficient for most trains, although it may be a limiting factor in the operation of large double stack trains, which can run over 8,000 feet.

Between Weso and Alazon, the UP line has automatic block signals (ABSs) only in the eastbound direction because this is the normal direction for traffic under joint operations. Trains receive warrants from the dispatcher to occupy track within the joint line limits. Although there are only four passing sidings on the UP portion of the joint track, operations are not impeded because trains on each line move in the same direction.

The UP has 12 trackside hot journal detectors along the mainline within Nevada. The spacing of these detectors averages 34.8 miles, but can be as much as 50.6 miles. The line has two dragging equipment detectors on its portion of the joint trackage. High water detectors are located in areas subject to flash flooding. The high water detectors are connected to the signal system, and cause normal block signals to display a restrictive signal when flooding occurs.

Traffic

Traffic on the Feather River Line has been increasing slowly since the UP takeover. When the UP bought the WP, the UP greatly reduced interchange with its historic transcontinental partner, the SP. Instead, traffic moved to the parallel ex-WP line. This forced the SP to initiate interchange arrangements with the WP's former partner, the Rio Grande.

Current traffic volumes on the UP through Nevada average six daily through-trains each way, versus the two to three daily trains that operated in the late WP era. These trains include both intermodal and general freight trains. The Valmy coal trains add a couple of trains per day on the east end, and the SP operates two to four trains between Flanigan and Weso each day. Extra trains operate as needed to handle grain, steel products, and other freight. In conjunction with American President Lines, the UP has been successful in marketing double stack service from the Port of Oakland. These trains are becoming an increasingly important part of the UP business.

There is little local business on the mainline in Nevada. Except for the U.S. Gypsum traffic out of Gerlach, most local work lies between Winnemucca and Wells. Outside of Sierra Pacific, there appear to be no high-volume shippers along this section.

In addition to its freight trains, the UP handles Amtrak trains 5 and 6 (the California Zephyr) between Salt Lake City and Winnemucca on a daily basis. The Zephyr makes station stops on the UP in Elko and Winnemucca.

Reno Branch

The Reno Branch extends 33.1 miles from a connection with the Feather River Line at Reno Junction, California (MP 341.8), to a connection with the SP Overland Route in downtown Reno, Nevada.

History

The Reno Branch was constructed as a narrow gauge line by the Nevada-California-Oregon Railroad (NCO). The WP purchased the southern portion of the NCO in 1917 to gain access to Reno. That portion of the NCO between Reno Junction and Reno was converted to standard gauge in 1918. The remainder was abandoned.

Route Description

The alignment of the Reno Branch is hilly and winding, a legacy of its narrow gauge origins. There are few stretches of straight track that are more than one-half mile long.

The branch leaves Reno Junction (Branch MP 0.0) and descends through 2.2 miles of grades reaching 1.8 percent. It then begins a 14-mile climb at an average 0.85 percent grade. The Nevada state line is at MP 11.0.

Beyond MP 16.5, the line begins a descent to Reno, with a continuous downgrade averaging 1.1 percent, but reaching 2 percent for short stretches. MP 20.0 marks the beginning of the Reno industrial area, and a lead to the North Reno Industrial Park is located at MP 21.3. The UP's small Reno area yard is at North Reno (MP 28.5). Between this point and the SP interchange, the line serves several small industrial areas.

Physical Plant

The branch has 100-pound, secondhand jointed rail that was placed in 1974. Overall track condition is good. Maximum car weight limits are the same as those of the mainline, but 6-axle locomotives are not allowed on the last 2.5 miles of the branch in Reno.

Train speeds are limited to 25 mph. The low speeds are a result of extreme curves and grades, not track condition. Portions of the branch have curves up to 12 degrees, which is quite sharp for modern equipment.

The Reno Branch is operated under a combination of track warrant control and yard limits. Track warrant territory extends from Reno Junction to MP 20.0. Yard limits extend from this point to the end of the branch.

Traffic

Five or six days per week, the Reno Branch carries a train making a round-trip out of Portola, California. The traffic load on the branch is currently quite good, with a variety of commodities being handled, including some intermodal traffic. Most of the local business on the branch is in the industrial areas north of downtown Reno.

3 SOUTHERN PACIFIC RAILROAD - OVERLAND ROUTE

The SP Overland Route extends 779 miles between Oakland, California, and Ogden, Utah. About 440 miles of the line span northern Nevada, extending in a west-east direction roughly between Verdi, Nevada, and Lucin, Utah. Two branches extend from the mainline at Hazen, Nevada, to Thorne and Fallon. Figure 3 shows both the mainline and the two branches.

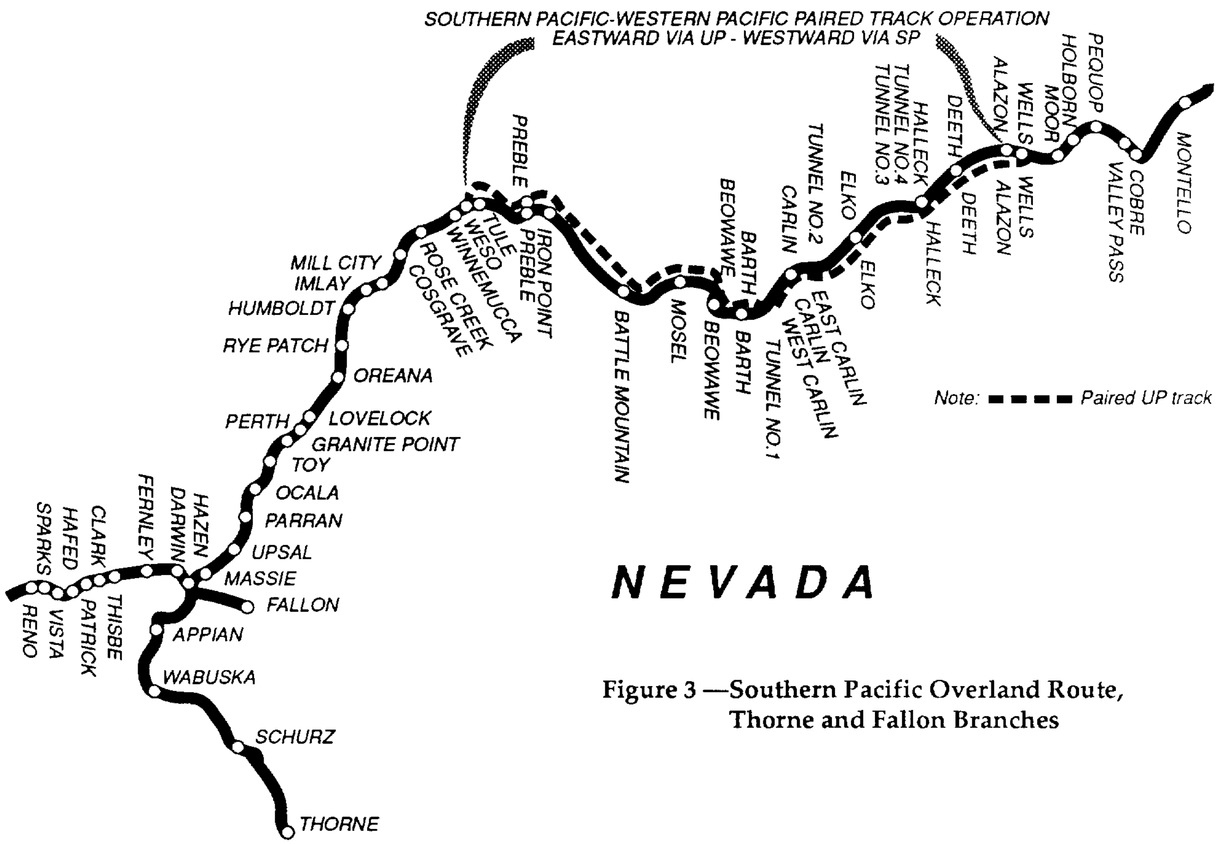

Figure 3 —Southern Pacific Overland Route, Thorne and Fallon Branches

Mainline

History

During the 1830s, images of a transcontinental railroad system were envisioned by gold seekers in the East hungering for fortunes to be had in California and Nevada's Comstock Lode. On July 1, 1862, this dream of a transcontinental railroad system moved closer to realization when President Abraham Lincoln signed the Pacific Railroad Act into law.

The Central Pacific Rail Road Company (CP) of California had been incorporated on June 28, 1861. While Theodore Dehone Judah was initially the driving force behind the massive CP construction effort, he fell ill and died at the age of 38. His backers, California businessmen Mark Hopkins, Collis P. Huntington, Charles Crocker, and Leland Stanford, (soon to become known as the legendary "Big Four"), took over Judah's dream. The first spike was driven in Sacramento on January 8, 1863, beginning the long, arduous task to open up the West. It took over five years to extend the CP's line some 140 miles from Sacramento to the California-Nevada border. Workers waged an epic struggle to overcome the rugged Sierra Nevadas, where snow storms, flooding, and mountains of granite all opposed the railroad's construction.

In 1866, the CP received word which energized its exhausted forces. The UP was building west from Omaha toward the Pacific coast. The CP was to continue construction until it met the UP rails, wherever that might be. For the determined Big Four, the farther east the meeting, the better. Extra shifts were established and a race to the finish was ignited.

An 1864 act of Congress allowed the CP to enter the Nevada Territory for 150 miles. Later, an act of the Territorial Legislature permitted the company to continue construction to the Utah border. The track across northern Nevada was built during the period from 1868 to 1869. Construction continued from Reno (June 19, 1868) northeasterly to Winnemucca (October 1, 1868), with tracks laid at an average rate of three miles per day. A record was set on August 19, 1868, when eight miles were laid. By January 25, 1869, the line stretched to Elko, less than 120 miles from the Utah line.

The UP was aware of the CP's progress and sent surveyors to parts of Nevada, even though UP construction was still east of Ogden, Utah. Nearly 3,000 UP laborers were sent to Wells, Nevada, to build eastward to Ogden. The workers were soon withdrawn, however, as the two railroads agreed to meet at Promontory, Utah. The CP laid its last rail at that point on May 1, followed shortly by the UP. On May 10, 1869, the final spike was driven, and the transcontinental line was complete.

In Nevada, the CP followed the Humboldt River Valley, a tame route in comparison to the California portion. Although geography simplified construction, potable drinking water had to be transported for miles to supply workmen at the railhead.

By the late 1800s, the CP had become part of the SP. The SP was a powerful company with two transcontinental routes—the Overland Route and the Sunset Route. The Sunset Route was completed in 1883 and ran from southern California through Arizona, New Mexico, and Texas, to New Orleans, Louisiana. In addition, the SP had a virtual lock on rail traffic within California. Its Overland Route did not initially generate significant traffic, however. Hastily constructed tracks on the UP portion required substantial upgrading to handle any significant traffic volume. Unfortunately, the UP had fallen prey to financial manipulators, ultimately ending up in the hands of Jay Gould and Russell Sage. These men's exploits drove the UP into receivership in 1893, leaving it in deplorable condition and unable to raise money. The UP's weakness limited SP's ability to exploit the Overland Route.

In 1897, railroad magnate E.H. Harriman took control of the UP. Harriman, who was to eventually control over 21,000 miles of railroad, immediately took steps to revive his new acquisition. After completing this task, he resumed the expansion of his empire. In 1901, the death of C.P. Huntington gave Harriman the opportunity to purchase the SP. By uniting the sections of the old Pacific Railroad under a single ownership, Harriman was in a position to fulfill the original promise of the route.

Sections of the SP alignment in Nevada, such as those in the Palisade Canyon, were extensively reworked at the turn of the century to reduce curves and grades. Double track was also installed in numerous locations. In 1904, the SP bridged the Great Salt Lake on causeways and a 12-mile-long trestle. This shortcut to Ogden, called the Lucin cutoff, bypassed the historic Promontory line and cut 44 miles off the Ogden-Sacramento run.

Concerned over monopoly powers, the courts eventually forced Harriman to divest the SP. By this time, however, the Overland Route had been well-established. The tracks on both the SP and the UP had been upgraded to handle heavy traffic. The traffic patterns and interchange agreements that were developed during Harriman's ownership were unaffected by the divestiture.

Route Description

This description of the Overland Route in Nevada proceeds from west to east in accordance with the SP mileposts. The track profiles in Appendix B provide additional information on the line.

The Overland Route descends into Nevada from the summit of the Sierra Nevadas at Donner Pass, entering the state just west of Verdi (MP 231.7). At this point, the line is double track with automatic block signalling. Although the grade is as high as 2.3 percent in the Sierras, the grades just east of the Nevada-California line are about 1 percent.

Traveling eastbound, Reno (MP 242.9) is the first population center reached and the largest in Nevada along the line. The tracks pass through downtown Reno en route to Sparks (MP 246.2). Here, the SP has a freight yard, engine servicing facility, and crew change point. Westbound crews operate to Roseville and Sacramento, California; eastbound crews operate to Carlin, Nevada.

From Sparks, the line follows the valley of the Truckee River east on a gradual descent. Vista (MP 249.3) marks the end of double track. Beyond this point, the line is single track under CTC.

Fernley (MP 276.1) is the former junction with the Modoc Line. Hazen (MP 288.1) is the junction point for the branches to Thorne and Fallon. The Thorne Branch at one time extended into eastern California. It has gradually been cut back, the portion between Thorne and Mina being the line most recently abandoned.

East of Hazen, the line is almost flat as it proceeds into the Humboldt River Valley. At Perth (MP 340.5), double track begins and CTC ends. Lovelock (MP 344.3) is the first population center reached after Hazen. Here the line begins to parallel the Humboldt River, whose valley provides a path for the rails through most of the rest of Nevada. The gradient also begins a very gradual ascent.

At Rose Creek (MP 406.8), double track ends and CTC resumes. Just to the east, the line enters Winnemucca (MP 417.3). The UP mainline from Oakland joins the SP at Weso (MP 420.9). The next 182.7 miles of line to Alazon (MP 603.6) are operated as joint track, with trains of both railroads using the SP line for westbound movements. CTC ends at Weso. The SP line has automatic block signals for westbound trains between Weso and Alazon.

For the next 100 miles, the SP and UP mainlines parallel through the Humboldt River Valley. The SP track is on the southern side of the UP track. Spacing of the two lines varies, and at times they are separated by several miles.

At Valmy (MP 457.5), a spur connects the SP and UP mainlines. On this connection Sierra Pacific Power has a generating station which is served by both railroads.

Between Barth (MP 520.3) and Carlin (MP 534.5), the railroads squeeze through Palisade Canyon. The narrow canyon forces the UP line to fly over the SP, and the UP remains to the south of the SP the rest of the way to Alazon. The two railroads also remain in close proximity.

Carlin is the crew change point for SP trains. Crews operate to the east 248 miles to Ogden. The SP has a small freight yard in Carlin. Elko (MP 557.0), the first major community east of Carlin, is where UP trains make their crew change. East of Elko, the railroad gradually climbs to Alazon. There, the UP line splits off to continue to Salt Lake City. The SP expands to double track east of Alazon.

At Wells (MP 607.5), the SP begins an ascent out of the Humboldt drainage basin and over the Peoquop Range. Grades on this segment reach 1.4 percent over the next nine miles to Moor (MP 616.4). At Moor, the double track ends and CTC resumes. The line then swings around the north end of the Peoquops to Valley Pass (MP 640.6) and begins a descent into the Steptoe Valley. At Valley Pass, double track resumes.

Cobre (MP 644.8) is the junction point with the Nevada Northern Railroad, which is temporarily shut down. Beyond Cobre, the SP bends northeast to enter the Loray Wash. The line descends at grades of up to 1.3 percent as it makes its way into the Tecoma Valley. Montello (MP 661.9) is the last settlement along the line in Nevada.

Physical Plant

The Overland Route in Nevada is a well engineered and maintained rail line. The operational and maintenance headaches — Donner Pass and the Great Salt Lake causeway — are outside Nevada. Even considering these, the Overland Route is capable of handling heavy traffic. Sizable portions of the mainline have welded rail, and rail weights are heavy, ranging from 119 to 136 pounds per yard. Gross weight limits for cars on the SP mainline are:

4-axle cars	—	315,000 lb
6-axle cars	—	395,000 lb
8-axle cars	—	526,000 lb

The 315,000-lb load limit for 4-axle cars is a further indication of high standards. Routine movement of these heavy cars may be difficult, at least eastbound, because of the UP's 263,000-lb limit on its portion of the joint track.

Train speeds are affected by alignment, consist, and signal systems, but many miles of the line allow freight train speeds of 70 mph and passenger train speeds of 79 mph. Passenger and freight trains moving on double track against the current of traffic are limited by the signal system to 59 mph and 49 mph, respectively. All in all, the line probably has the capacity to handle 50 or more trains per day, far more than the current volume.

SP dispatchers are located in Roseville, California. Train crews communicate with the dispatcher via radio. Sections of CTC extend between Vista (MP 249.1) and Perth (MP 340.5), Rose Creek (MP 406.6) and Weso (MP 420.9), and Moor (MP 616.4) and Valley Pass (MP 640.6) for a total of 129.9 miles. These sections of the line are single track, with 16 controlled sidings for train meets and passes. The SP is converting an additional segment between Rose Creek and Humboldt (MP 377.0) to CTC. The average siding length is 7,668 feet. The longest siding is at Upsal (MP 302.0) and is 10,200 feet long. Siding spacing ranges from 3.6 to 10.5 miles, with an average of about 8 miles.

The SP's Nevada double track, including the joint line portion, has automatic block signalling for the current of traffic only. Double track sections in Nevada extend from the California line to Vista (MP 249.1), Perth (MP 340.5) to Rose Creek (MP 406.6), Weso (MP 420.9) to Alazon (MP 603.6), Alazon (MP 603.6) to Moor (MP 616.4), and Valley Pass (MP 640.6) to the Utah line for a total of about 310 miles. Passing sidings are located along the double track, but at greater spacing than on the single track because they are normally needed only for overtaking movements.

The SP has a plentiful supply of train defect detectors spaced out along the mainline in Nevada. These detectors include 22 hot journal and 29 dragging equipment detectors. A number of these, of course, only serve one direction of traffic. In addition, the railroad has a number of rock slide detectors as well as several highway overpass collision detectors. The track profiles in Appendix B show detector locations.

Traffic

Current average traffic volumes on the Overland Route are difficult to determine. The combined SP/ Rio Grande system is still developing traffic on the corridor. Current indications are that SP traffic averages eight to ten trains per day each way between Weso and Ogden. West of Weso, the figure drops to about eight trains per day. This traffic includes both intermodal and general merchandise traffic. UP traffic would have to be added to the SP volumes on the joint line.

Clearance restrictions have thus far prevented double stack movement to and from the Oakland area. The SP has moved some double stack traffic from Portland east over the Modoc Line. It does not appear, however, that this will be a significant growth area for the Overland Route. Future traffic increases will depend upon the revival of the Pacific Northwest lumber industry. A line purchased in 1989 now extends SP rails from St. Louis to Chicago. Additional trackage rights provide another route between Kansas City and Chicago. These connections may make the Overland Route more competitive with the UP.

While the SP generates some local freight traffic on the Fallon and Thorne branches and in the communities along the joint trackage, most traffic centers around the Reno/Sparks area. Sparks is a major warehousing center for companies doing business in California. The SP has an intermodal facility there, and numerous sidings serve the local businesses.

The SP hosts Amtrak trains 5 and 6 (the California Zephyr) west of Alazon on a daily basis. The Zephyr makes station stops on the SP in Elko, Winnemucca, Sparks, and Reno.

Modoc Line

The Modoc Line serves as a cutoff for SP traffic moving between the Pacific Northwest and points to the east. It connects the SP's north-south mainline between California and Oregon with the Overland Route.

History

In 1914, the SP built a line from Fernley, Nevada, northwest into the California lumber country around Susanville and Westwood. The Nevada-California-Oregon Railroad was purchased in 1926 to serve as the middle portion of an extension of this branch to Klamath Falls, Oregon. The route between Fernley and Klamath Falls became known as the Modoc Line, an important cutoff for freight moving over the SP between the Pacific Northwest and points east.

The 60-mile section of the Modoc Line between Flanigan and Fernley was abandoned in 1963 in favor of trackage rights over the WP between Flanigan and Weso, Nevada. The Flanigan-Fernley section of the line passed through barren desert country devoid of revenue, and the SP had no use for the line.

Route Description

The Modoc Line has less than seven miles of SP-owned track in Nevada. To connect SP Overland Route rails at Weso with the beginning of the Modoc Line at Flanigan, the SP uses 151 miles of trackage rights acquired from the UP (formerly WP) in 1962. Chapter 2 describes this line. SP track ownership begins at Flanigan (MP 336.4) and extends on a level grade towards Herlong, California. The California state line is at MP 343.2. The line passes through uninhabited territory in Nevada.

Physical Plant

Maximum gross weights for cars on the Modoc Line are the same as for the Overland Route; 125-ton payload cars are allowed. The UP allows only 263,000 pounds of gross weight for 4-axle cars, however. Because UP rails must be used to travel from the Modoc Line to the Overland Route, the UP's weight limits govern through-car weights.

Trains are allowed a maximum speed of 40 mph on the SP portion of the line. Within California and Oregon, the route has a number of grades in the 1 to 2 percent range and numerous curves, which limit speeds.

The portion of the Modoc Line extending between the UP connection at Flanigan and MP 337.9 is double track, using automatic block signalling. From MP 337.9 to MP 356.0, the line is under CTC operation. Beyond this point, the SP uses direct traffic control (DTC).

Traffic

The SP usually operates three daily trains over the Modoc Line, one eastbound and two westbound. These trains carry general merchandise between Eugene, Oregon, and St. Louis, Missouri. These trains provide local service along the line as well.

Thorne and Fallon Branches

The Thorne (formerly Mina) and Fallon branches are relatively unimportant pieces of SP track at the current time. They serve local industries and are not maintained to mainline standards.

History

The Thorne Branch runs between Hazen and Thorne. This branch, which is the SP's longest in Nevada, is today a minor line. Nevertheless, it had an interesting role in the Nevada rail scene at one time. A portion of the line's history is presented below.

By the late 1870s, the fabled Comstock Lode in Nevada was wearing thin. Surrounding mines, however, were prepared to offer persistent men a wealth of opportunity. The ore was there, but adequate rail service was not. H. M. Yerington intended to meet this demand when he unveiled plans for his new Carson & Colorado Railroad (C&C) on May 10, 1880. This narrow gauge line would extend from Mound House, Nevada, to Ft. Mojave, California.

The monumental task of building a railroad through this untamed land required an army of able-bodied men. Miners who had come up empty at Comstock lent their eager support. Construction began on May 31, 1880, at Mound House, moved along the Carson River down to Dayton, then across the

Carson River to Fort Churchill. By October, the rail extended 100 miles to the small, virtually uninhabited town of Hawthorne, Nevada.

Construction continued through Mt. Montgomery Pass to Candelaria, where a station was erected. Gale force winds plagued the area, and the new building was soon blown off its site and sent rolling through the town. Much chagrined, the railroaders carried the toppled building back and replanted it, being careful this time to fasten it down securely. Following this episode, construction continued across the California state line and on to Keeler. From this point, the Nevada and California Railway extended the rails to Mojave. The line then provided a through route, albeit with a change in track gauges, between California and Nevada.

In March 1900, the SP bought the C&C. With the new ownership, changes were made beginning with the relocation of the line around Hawthorne. Realignments to reduce trackage and decrease transit time left the town isolated from the rails. On August 18, 1905, citizens of Hawthorne witnessed the last train to service the town. Soon after, the old narrow gauge tracks were taken up.

Under the Harriman regime, the SP had big plans for the C&C. In the spring of 1905, the SP built a connection between the Overland Route at Hazen and the C&C's line at Fort Churchill. Completion of the Virginia and Truckee Railroad in 1905 also gave the C&C line a direct connection into Reno.

As mining traffic dwindled over the years, portions of the former C&C line and its connections were gradually abandoned. The narrow gauge line over Mt. Montgomery Pass, too costly to operate as a competitive freight route, was abandoned. The Mound House-Fort Churchill portion of the original mainline was also abandoned, along with the Virginia and Truckee.

Route Description

The Thorne Branch is the only remaining remnant of the former C&C line. Most of the line travels through relatively unpopulated country. It proceeds in a southwesterly direction from Hazen over a fairly level alignment to Wabuska, where it makes a turn to the southeast. The branch terminates near Hawthorne, 96.3 miles from Hazen, where the military operates a munitions plant.

The Fallon Branch extends 15.8 miles between Hazen and Fallon, where the SP serves local industry. The line is relatively straight and level between its endpoints. The SP has no intermediate stations, and the line passes through no en route communities.

Physical Plant

DTC is in effect over most of the Thorne Branch, and train speeds are limited to 25 mph. The branch has the following load limits:

4-axle cars Hazen-Wabuska (MP 328.0)	—	281,000 lb
4-axle cars Wabuska-Thorne	—	195,000 lb
6-axle cars (prohibited Wabuska-Thorne)	—	395,000 lb
8-axle cars (prohibited Wabuska-Thorne)	—	526,000 lb

The low weight limit east of Wabuska is indicative of poor track conditions. The limit restricts payload weights to 65 to 70 tons per car, a factor which increases shipping costs for many commodities and makes the line much less attractive to shippers.

The Fallon Branch operates under yard limit rules, and train speeds are limited to 20 mph. Equipment load limits are:

4-axle cars	—	263,000 lb
6-axle cars	—	395,000 lb
8-axle cars	—	526,000 lb

Traffic

Little information was available on the traffic patterns of either branch. Neither has many shippers, and service is presumably provided as needed.

4 UNION PACIFIC RAILROAD - LA & SL LINE

The LA & SL Line of the UP stretches 784 miles across Utah, Nevada, and California to connect its namesake cities. About 212 miles of the route lie in Nevada. Short branches extend in Nevada from the mainline to Henderson and Mead Lake. Spurs serve Nellis Air Force Base and a gypsum plant. Figure 4 shows the LA & SL Line's Nevada trackage.

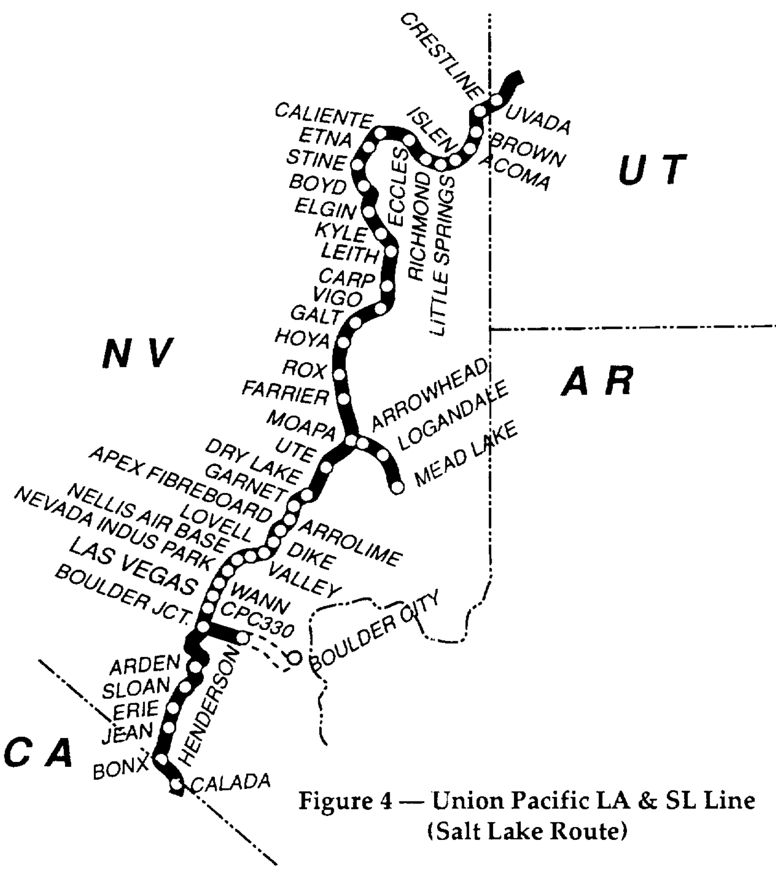

Figure 4 — Union Pacific LA & SL Line (Salt Lake Route)

Mainline

History

In 1880, the UP's aspirations of extending rails from Salt Lake City southwestward into southern California were becoming a reality. A multitude of railroads had been grouped together to form the UP's Oregon Short Line & Utah Northern Railroad (OSL), Which was responsible for clearing the way from Salt Lake City to Barstow, California. The UP had, through its Nevada Pacific subsidiary, applied to the United States Land Office for a right-of-way across Nevada.

When work halted in February 1891, 110 miles of grading had been completed at an estimated cost of $21,418,000. Financier Jay Gould's control of the UP had driven it to the brink of bankruptcy, and no more cash was available for the California extension. The workers left behind a completed grade between Milford, Utah, and Uvada, on the Utah-Nevada line, along with some completed bridges. Between Uvada and Culverwell (present-day Caliente), the grade was partially complete, and six tunnels had been driven. South of Milford, 7.75 miles of track had been laid, but the rails were soon lifted.

October 1883 saw the UP placed in receivership. Concerned with preserving the core of the railroad, the receivers cared little about unproductive assets. The California extension grade was abandoned. In 1894, Lincoln County, Nevada, repossessed the unfinished Uvada-Caliente portion and placed it on sale for back taxes.

On November 1, 1897, railroad magnate E.H. Harriman and his associates took control of the UP. Harriman immediately set about to revitalize his property. Within a short time, he had accomplished this task and began to renew long-delayed expansion plans. Harriman associates established the Utah & Pacific Railroad (U&P) in October 1898 to lay the first 75 miles of rail between Milford and Uvada. This task was completed on July 24, 1899. In the same year, Harriman's forces chartered yet another railroad, the Utah, Nevada, and California, which was established to construct rail lines across Nevada from Uvada to the California state line. The purpose of this move was to lay claim to the unfinished Clover Creek Canyon grade that had been abandoned by the Nevada Pacific. For the time being, however, Harriman could do nothing. The rival SP threatened to build its own line if the UP went ahead with construction of the proposed California extension.

Then Senator William A. Clark entered the scene. Senator Clark, a noted Montana capitalist, had amassed a fortune in banking and mining. He and his family had been making investments in southern California, and he felt the railroad would have strategic importance both as a transcontinental route and in the development of the southern California region. Senator Clark purchased the Utah and California Railroad (U&C), a railroad established but at the time still without approval to build from Salt Lake City to the Nevada-Utah line. In August 1900, he bought the Los Angeles Terminal Railway and began surveys for an independent railroad to Salt Lake City. On March 20, 1901, Clark chartered the San Pedro, Los Angeles, and Salt Lake Railroad (SP, LA & SL) to accomplish this goal, folding his existing properties into this new road.

C. P. Huntington's death in 1901 allowed Harriman to purchase SP stock and to acquire control of that railroad. This strategic move gave him access to the Pacific coast. It also left him free to resume plans for the UP's southern California extension.

Clark's announcement of his intentions to build towards Salt Lake City aroused Harriman's anger, igniting an epic struggle that would be waged for two tumultuous years in the field and the courts. When word of Harriman's acquisition came out, a local newspaper asked Clark if his railroad would connect with the OSL at Uvada. Clark replied that his company planned to have its own line all the way from Salt Lake to Los Angeles. This dispelled any idea of a joint effort between the two men. Clark soon rebuffed an effort by Harriman to purchase the SP, LA & SL.

On March 4, 1901, Clark's attorney requested that Lincoln County, Nevada, transfer ownership of the old OSL grade to the U&C. The request carried with it an option payment of $5,083 and a provision that, within six months, the U&C would construct a standard gauge railroad over the Uvada-to-Caliente section of the route. The request was accepted. Soon after, the passing of Nevada Senate Bill 38 permitted the U&C to build a railroad over the grade.

At this point, Senator Clark possessed a railroad in Los Angeles, a paper railroad in Utah, the preliminary ownership of OSL grade, and the right to build in Nevada. Harriman's U&P was operating up to Uvada only, and his Utah, Nevada, & California Railroad had yet to begin construction.

A dispute soon arose over the rights to construct through the narrow Clover Creek Canyon between Uvada and Caliente. Both Clark and Harriman had submitted surveys for the area, but Harriman's had never been approved. Nevada had given title to Clark's U&C, giving him sole ownership of this important stretch of land. Harriman's forces began construction anyway, setting off a hard-fought struggle for possession.

On April 24, 1901, Secretary of the Interior Hitchcock reversed the ruling of the officials in Carson City, decreeing that the U&C had no right under its charter to acquire the Nevada Pacific Grade. A further ruling of the U.S. Circuit Court restrained Clark's forces from keeping OSL construction forces out of the canyon. Now Harriman's OSL had the right to lay track along the Clover Creek Canyon route, but not to use the grade to which Clark had preliminary ownership. Unfortunately, the narrow canyon had room for only one railroad.

At this point, both companies shifted their attentions to the Meadow Valley Wash south of Caliente. Here, the SP, LA & SL lawyers were successful in stopping their rivals. The courts restrained the OSL forces from interfering with Clark's workers in the Meadow Valley Wash.

Both sides virtually halted construction for nearly 18 months between 1901 and mid-1903. The reason, undisclosed to most, was the calling of a truce between the railroads so that side-by-side surveys could be conducted through the Meadow Valley Wash. During the surveys, it became apparent that only one rail line could practically be constructed within the narrow confines of the wash. Because neither could obtain the necessary right-of-way, Harriman and Clark realized that compromise was necessary. In July 1902, Clark agreed to sell Harriman half interest in the SP, LA & SP if all UP properties south of Salt Lake City were transferred to his road.

With the feud settled, construction began again, now at a frenzied pace because connection of the two sections of rail was in sight. On January 20, 1905, the final spike was driven at MP 306.25, between Jean and Erie in Nevada. Although an elaborate public ceremony had not been planned, it was believed that, at the least, a gold spike would be cast to complete the line. These plans were considered frivolous and were forgotten by all except for the wife of the Los Angeles Daily Times general manager. She had fashioned a miniature spike of gold which was pressed by thumb into the last tie, thereby concluding the ceremony. Full passenger service between Los Angeles and Salt Lake City began on May 1, 1905.

Early in the line's operations, the UP realized that constructing tracks within the flood zone of the Meadow Valley Wash south of Caliente was a costly mistake. Several times floods washed away major portions of the line. During 1911 to 1912, 68 miles of track in Clover Creek Canyon and Meadow Valley Wash were reconstructed on a higher alignment. The UP acquired the remaining one-half interest held by the Clark faction in 1921. Since that time, the UP has steadily upgraded the line. Between 1942 and 1945, the railroad installed CTC on the line through Nevada. In the mid 1980s, a siding and signal improvement program was initiated to improve operations. A major construction project completed in 1982 eliminated the famous Crestline horseshoe curve.

Route Description

The UP line through Nevada is one of the most isolated pieces of railroad in the United States, encountering almost no other population center in the state other than Las Vegas. Most of the line traverses rugged desert country.

After cresting the 2.2 percent grade up Cima Hill in California, the UP enters Nevada at Calada (MP 287.9). East of Calada, the line begins 16 miles of 1.0 percent climb to Erie (MP 309.0). Here, the profile reverses, beginning 29 miles of descent at grades of up to 1.0 percent to Wann (MP 338.7).

From near Arden (MP 321.8), the Blue Diamond spur extended west 10.6 miles to a gypsum mine and processing complex. The spur, built in 1925, was removed in 1987. Double track begins at MP 326.35 as the line enters the Las Vegas area. At Boulder Junction (MP 327.9), the 10.9-mile BMI branch to Henderson departs the mainline.

Las Vegas (MP 334.3) is the site of a yard, engine servicing facility, and crew change point. Crews work from Las Vegas east to Milford, Utah, and west to Yermo, California. The UP is currently designing a new yard for the Las Vegas area, which will be located to the north of downtown. The present downtown yard adjacent to the Las Vegas strip will be redeveloped, and the engine servicing facility will be relocated to California. Las Vegas area double track ends at MP 336.3. Leaving Las Vegas, the railroad penetrates over 100 miles of virtually uninhabited territory.

From Wann, the rails begin yet another 1 percent climb to Apex (MP 352.0). Here, the 11.3 mile Fibreboard spur leaves the mainline to serve a gypsum plant. The line begins 31.5 miles of descending profile at grades of up to 1 percent beyond Apex, finally ending in the Moapa Valley at Moapa (MP 383.5). At 1,608 feet above sea level, the Moapa River crossing is the lowest point on the railroad in Nevada. From the Moapa siding, a 17.1-mile branch extends to Mead Lake. Moapa is also the site of a power generating station.

Beyond Moapa, the railroad turns to parallel the famous Meadow Valley Wash, whose floods plagued the builders of the line. The rails climb continuously for the next 113 miles. From Moapa to Carp (MP 418.4) the grade averages 1 percent. From Carp to MP 467, the grade increases to 1.5 percent. Numerous stretches of curves hold down train speeds in the wash.

Caliente (MP 459.8), the first population center east of Las Vegas, is a former major railroad town and junction point. Until 1984, the Pioche Branch extended 42 miles north to Pioche. At Caliente, the rails depart Meadow Valley Wash for Clover Creek Canyon. The many short curves in the Canyon between MP 469 and MP 478 restrict train speeds to as low as 20 mph.

The final section of the grade to Crestline (MP 496.8) tops out at 2.06 percent. At an elevation of 5,992 feet, Crestline is the highest point on the railroad in Nevada. The rugged section of railroad between Moapa and Crestline contains 15 tunnels and a number of large steel viaducts.

From Crestline, the railroad descends on 1 percent grades crossing the Utah border at MP 500.5 just west of Uvada, Utah. Until 1982, a severe horseshoe curve east of Crestline restricted train speeds to 20 mph. A track realignment eliminated this curve, reduced the mainline length by one mile, and raised train speeds to 50 mph.

Physical Plant

The LA & SL Line is an important arm of a prosperous railroad. Consequently, it has always had heavy traffic and adequate maintenance. Furthermore, the railroad has continued to make alignment changes to improve operations. Most of the tunnels are bored for double track, should traffic volumes warrant its installation.

As shown in Appendix B, the LA & SL Line has somewhat of a roller coaster profile in Nevada. Despite this, the line is extremely well engineered considering the terrain. Because of the importance of the route, the UP adheres to a high maintenance standard. The company has heavy welded rail (mostly 133 pounds per yard) along the route and is currently installing long-life concrete crossties in the Meadow Valley Wash and Clover Creek Canyon.

The UP maintains the following gross weight restrictions for cars on the LA & SL Line, including the branches:

4-axle cars	—	263,000 lb
6-axle cars	—	394,000 lb
8-axle cars	—	526,000 lb

Specific 4-axle cars of 315,000 lb gross weight can be handled. Six-axle locomotives are allowed over all portions of the line.

The excellent track conditions allow maximum freight train speeds of 60 mph east of Las Vegas and 70 mph west where grades and curve factors permit. Passenger trains are allowed up to 79 mph. Curves in the Clover Creek Canyon and the Meadow Valley Wash restrict train speeds at various points.

Trains operate on the mainline under CTC, with dispatchers located in the new UP System dispatching center in Omaha, Nebraska. Train crews have direct radio communications with the dispatcher.

The dispatchers control passing sidings spaced at intervals ranging from 3.9 to 10.6 miles, with the average being about 7 miles. All the sidings have power-operated turnouts operated by the CTC dispatcher. Sidings average 7,263 feet; the minimum siding length is 5,730 feet, and most exceed 6,000 feet. Roughly every fourth siding is being increased to a minimum of 8,900 feet to handle long double stack trains. The signal system is being upgraded at the same time to increase capacity.

The UP has 6 trackside hot journal detectors and 14 dragging equipment detectors along the mainline within Nevada. The railroad has also installed high-water detectors in flood-prone areas to warn oncoming trains of unsafe conditions. The profile in Appendix B shows the locations of these safety devices.

Traffic

Traffic on the LA & SL Line has always been heavy, although current volumes are far below the peaks experienced in World War II. Current traffic volumes average 12 to 14 daily through freight trains each way. These trains include both intermodal and general freight trains. The Moapa coal trains add a couple of trains per day on the east end. Double stack service from the Intermodal Container Transfer Facility at Long Beach, California, is becoming an increasingly important part of the UP business.

Local business on the line is mostly concentrated around Las Vegas. The BMI Branch and the Fibreboard Spur generate sizable carloadings. The UP has an automobile unloading facility in North Las Vegas. About 80 percent of the lumber used in Las Vegas is delivered by rail to a facility at the UP's yard.

In addition to its freight trains, the UP handles Amtrak trains 35 and 36 (the Desert Wind) between Salt Lake City and Barstow, California, on a daily basis. The Desert Wind makes a Nevada station stop in Las Vegas.

Branches

Five branches or spurs extend from the LA & SL Line within Nevada. These are the BMI Branch, the Mead Lake Branch, the Fibreboard Spur, the Lovell Spur, and the Nellis Spur. These lines feed local traffic into the mainline.

History

The BMI Branch was constructed during 1930-31 to support construction of Hoover Dam. The branch originally extended 22.8 miles to Boulder City. A number of major industries were built in the Henderson area during World War II to take advantage of the inexpensive electric power provided by the dam. The portion of the line from Henderson to Boulder City was donated to the Nevada State Railroad Museum in 1985.

The 21.6-mile Mead Lake Branch was built between Moapa and St. Thomas, Nevada, in 1911. St. Thomas was a community located on the rim of the Grand Canyon of the Colorado River. The area along the line was a rich agricultural area. St. Thomas was flooded by the filling of Lake Mead in 1939, and the branch was cut back 4.46 miles.

The Nellis and Lovell spurs extend from the mainline just north of Las Vegas to serve the Nellis Air Force Base complex. They were constructed in 1941.

The Fibreboard Spur extends 11.3 miles from Apex to a processing plant of the Pabsco Gypsum Co. The spur was constructed in 1965.

Route Description

The BMI Branch extends from the mainline at Boulder Junction (Branch MP 0.0) to its current terminus at Henderson, a total of 10.8 miles. A two-mile spur extends to a magnesium processing facility in Henderson. The alignment is reasonably straight, with a continuous downgrade of 1 to 1.5 percent between the mainline and Henderson. The UP has no intermediate stations on the branch.

The Mead Lake Branch runs 17.2 miles from the mainline junction at Moapa to just beyond the railroad station of Mead Lake (MP 16.7). The route follows the Muddy River. The alignment is typical branchline construction, with a gradual downhill descent from Moapa at grades of up to 2 percent. The line is fairly straight except for a five-mile stretch in the Muddy River narrows. Industry tracks are located at Arrowhead (MP 3.3), Logandale (MP 10.2), and Mead Lake.

The Fibreboard Spur is another typical industrial spur, with an up-and-down profile with grades of 0.6 to 1.9 percent. No intermediate stations are located on the spur, and the territory is uninhabited.

Physical Plant

Rail on all the branches is of jointed construction ranging from 90 to 133 pounds per yard. Speeds on the branches range between 10 and 25 mph depending upon the alignment and profile. Considering the short length of these operations, the low speeds are not a hindrance.

The BMI and Mead Lake branches are operated under track warrant control. The Fibreboard Spur is under yard limits.

Traffic

Traffic levels on the branches are not available, but active shippers are located on each. The BMI Branch is probably the most productive, because Henderson is a developing industrial area. The UP serves each line as needed, on a weekday basis.

5 THE NEVADA NORTHERN RAILROAD

The Nevada Northern Railroad (NN) is the last shortline railroad in Nevada. Currently shut down for common carrier operations, the line may be resurrected in the late 1990s to serve a proposed power project. Figure 5 shows the NN line.

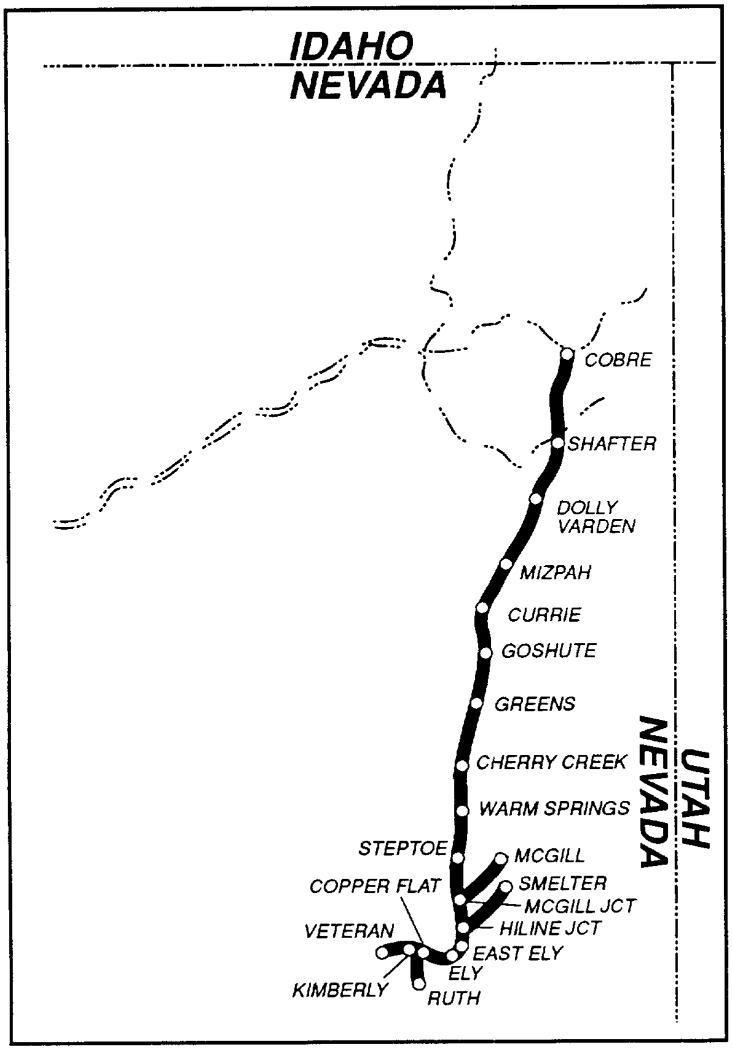

Figure 5 — Nevada Northern Railroad

History

Concerned about falling revenues in the late 1890s, the management of the narrow gauge Eureka & Palisades Railroad sent scouts out to look for mineral deposits. Although the scouts were unsuccessful in locating deposits along their railroad, they did locate large copper deposits near the town of Ely, some 75 miles from the railroad's end point. Mark Requa purchased land surrounding ore deposits in Copper Flat near Ely, and in 1903 he began the White Pine Copper Company to extract this valuable commodity from the hills. The copper deposits consisted of a low-grade ore, which required many tons to produce a single ton of copper.

One year later, the White Pine Copper Company and other mining interests combined to form the Nevada Consolidated Copper Company (NCCC). Requa, the operating manager, spearheaded efforts to build a railroad to haul the copper ore to the smelter and to ship the finished copper to market. On May 29, 1905, the NN was incorporated as a wholly owned subsidiary of the NCCC. Construction began at Cobre, Nevada, on September 11, 1905.

Completion to Ely was forecast for year's end, but the weather did not cooperate. After one full month, only 20 miles of grading were completed. Fifteen more miles were completed during a bitterly cold November and December. Many of the workmen then refused to sign on again, leaving to find work in better climates. Construction halted between December and March.

On June 2, 1906, passenger service was available from Cobre to Currie, Nevada. Only 77 miles of construction remained to reach Ely, where the population waited with eager anticipation. By September 29, 1906, the line had been extended to what is now the town of East Ely. September 29 and 30 were designated as "Railroad Days" to celebrate the coming of the iron horse. As was characteristic of the line, the laborers had to work to the very date of the celebration to complete the line.

Although the railroad had reached Ely, a 10-mile extension was necessary to reach the mines. Work continued to push the line on through Robinson Canyon to the copper pits at Veteran. In early May 1908, the first loads of ore were sent from the pits down the tracks. The track to the mine was completed on September 9, 1908. Further construction was begun later to build the nine-mile Mill Branch to the smelter and the three-mile Branch to McGill, Nevada. A bypass was soon built around Ely to reroute heavy ore trains around the community's streets.

The NN remained basically as constructed until environmental regulations forced the closing of the smelter on June 20, 1983. The railroad's heavy traffic centered on the movement of ore from the copper pits to the smelter. This activity took place on the south end of the railroad around Ely. Every day, a road train would make the trip to Shafter and Cobre with carloads of copper concentrate and refined copper, returning with company materials and an occasional carload of general freight. The closing of the smelter deprived the NN of its traffic base, and the last revenue train ran on June 20, 1983. At the close of operations, Kennecott Copper Company was the line's owner.

After closing the line, Kennecott donated the balance of the NN property south of McGill Junction (MP 128) to the White Pine Historical Railroad Foundation, which operates the property as a railroad museum. The Los Angeles Department of Water and Power (LADWP) purchased the remaining 128 miles of track between McGill Junction and Cobre to serve a proposed $3.8 billion, 1500-megawatt, coal-fired power plant to be located near Cherry Creek, Nevada. This development, called the White Pine Power Project, may be constructed during the late 1990s.

Route Description

The NN lies entirely within Nevada. It traverses high desert valleys in the eastern part of the state, running in a north-south direction between its endpoints.

The NN begins at the SP interchange in Cobre, Nevada (MP 0.0). From Cobre, the line proceeds south through the Goshute Valley, crossing the UP Feather River Line at Shafter. In 1986, the UP removed the physical crossing, but the interchange track is still in place. The line continues south through the Goshute Valley to Dolly Varden, where it begins to parallel Duck Creek. At Currie, the rails enter the Steptoe Valley. The portion between Cobre and Currie is extremely isolated; south of Currie, the railroad is at least paralleled by U.S. Highway 93. The line continues to follow Duck Creek all the way through the Steptoe Valley to McGill Junction. Ely is at MP 140.8.

Physical Plant

The alignment of the NN is basically straight and level in accordance with the gentle valley terrain in which the railroad lies. There are no tunnels or major bridges on the mainline. There is a small freight yard and shop complex at East Ely.

The LADWP will have to completely rebuild the NN to handle coal traffic, at least as far south as Cherry Creek. Rails north of McGill Junction weigh only 60 pounds per yard, which is extremely light by current standards. Grade crossings between Cobre and McGill Junction have also been paved over. The rebuilding will dictate the type of equipment and operating speeds allowed on the line. Under agreement with the railway museum, the LADWP will use the shops and yard at East Ely.

6 SYSTEM APPRAISAL AND FUTURE OUTLOOK

The railroad system in Nevada is in excellent physical condition, with only a few miles of branchline rails in substandard condition. Remaining rail lines in the state comprise a core system, and the obvious opportunities for further network reduction are limited to the few remaining branches. This chapter examines factors that may affect the future of the Nevada rail network.

Southern Pacific

The SP has had a number of setbacks during the 1980s that cloud the future of the Overland Route. Some of these have to do with economic declines in selected industries in the SP traffic base. Nature has also directly affected the Overland Route. The following paragraphs describe some of these problems.

During the early 1980s, serious financial concerns dogged SP management. First, deregulation of the railroad industry gave shippers more incentive to send freight over the shortest route between origin and destination. Unfortunately, many of the SP's routes were longer than those of the competition, especially in the lucrative Pacific Northwest. The UP's purchase of the WP heightened competition on the Overland Route and deprived the SP of its strong connection to the east. The amount of freight carried and revenues declined. Second, the SP had always been heavily dependent upon lumber products. In the 1980s, the Pacific lumber industry underwent a precipitous decline, and the SP lost a major portion of its revenue base. Traffic volumes on the Modoc Line, which was heavily dependent on lumber traffic, declined to the point where the SP made the decision not to offer through traffic service.

The Overland Route suffered a major blow in 1986 as water levels in the Great Salt Lake rose to record levels. The SP had replaced the trestle across the lake with a massive fill in 1959. By mid-1986, record snowmelts and rainfall had raised the lake level 21 feet above its 1963 level. The rising waters threatened to inundate the fills of the Lucin cutoff. Storms in the spring of 1986 caused severe damage to the SP line, forcing traffic to be rerouted via the UP between Salt Lake City and Alazon, Nevada. Unfortunately, the UP line was also threatened by the flooding and had to be elevated by over eight feet. Severe storms during June 5-7, 1986, destroyed over 11 miles of the line across the lake. It was to be 77 days before trains ran again. Minor storms continued to disrupt operations during 1986 and 1987. Restoring and maintaining operations on the line cost the SP millions of dollars.

In the mid-1980s, the SP and the Atchison, Topeka, and Santa Fe Railroad announced their intention to merge. A holding company called Santa Fe Southern Pacific (SFSP) was established for the merger. SFSP acquired the properties of both railroads, which included sizable non-railroad assets. The proposed merger of Santa Fe and SP surprised many industry analysts because the roads served much of the same territory, especially in California where they would have a virtual monopoly. Nevertheless, SFSP was shocked when the Interstate Commerce Commission (ICC) rejected the merger on June 30, 1987. The ICC ordered SFSP to sell one of the two railroads, and the company elected to sell the SP.

SFSP solicited bids for the SP in late 1987. After receiving a number of offers, the company accepted a bid from Rio Grande Industries (RGI), owner of the Denver and Rio Grande Western Railroad. ICC approval for this purchase was forthcoming, and the transaction was completed on October 13, 1988.

The Rio Grande is now the SP's primary connection on the east end of the Overland Route. Furthermore, RGI has trackage rights all the way to Kansas City as a condition of the UP/WP/Missouri Pacific merger. The new owner is optimistic that the combined Rio Grande and Overland Route trackage can renew the SP's ability to compete. After acquiring the SP, RGI reopened the Modoc Line to through service and began a campaign to improve train service on the Overland Route and Modoc Line.

Union Pacific

The Union Pacific Railway is a member of Union Pacific Corporation's (UPC) family of companies, which includes Overnite Transportation Co. (trucking), Union Pacific Resources (energy), Union Pacific Realty, Union Pacific Technologies (computing and communications), and USPCI (pollution control). The combined company had gross revenues in 1989 of $6.492 billion, with net profits of $595 million.

Transportation is UPC's core business, and the railroad is the centerpiece. The UP operates 24,882 route miles in 19 states, mostly in the west and midwest. In 1989, the railroad had gross operating revenues of $4.58 billion, with a net revenue of $547 million, a six percent increase over 1988. It had an operating ratio (expenses/income) of 80.6. Roadway capital and maintenance expenditures for 1989 totalled $305 million and $278 million, respectively. The UP states that the condition of its physical plant is the best since World War II.

In general, the UP is one of the nation's strongest railroads. The routes through Nevada are important transcontinental extensions of UP routes. Both mainlines appear to figure prominently in the railroad's future plans.

<u>Salt Lake Route</u>

Barring major changes in the economy, the LA & SL Line appears poised for an increase in traffic in the next decade. Double stack traffic from the Los Angeles area ports has been growing steadily over the past five years. The UP, in conjunction with American President Lines (APL), Mitsui, and other container lines, has become a major player in the double stack business out of Los Angeles. The railroad has announced that it plans to phase out all conventional trailer-on-flat-car (piggyback) trains within the next five years in favor of container operations, which will be handled under contract to APL.

The UP has also positioned itself for a portion of the domestic southern California automobile delivery business. The railroad opened two automobile unloading facilities in the region during 1990. Together, these two facilities are expected to handle over 200,000 automobiles delivered by train per year, or approximately 13,300 carloads per year.

Coal is the third projected growth commodity for the LA & SL Line. Some forecasters are predicting increased demand for low-sulfur coal in the Pacific Rim countries. This demand could be filled by Powder River coalfields. Construction of a coal loading facility for ships has been proposed for the Los Angeles area. Powder River coal would be transported over the UP to this loader.

Although none of this traffic increase is due to the Nevada economy, the increase will ensure that the UP commits adequate capital and maintenance dollars to the LA & SL Line. For Nevada rail shippers, this should ensure a high level of service.

<u>Feather River Line</u>

The Feather River Line gives the UP access to major markets in central and northern California. However, the Feather River Line has several drawbacks. First, it is paralleled throughout its length by a rival line, the SP Overland Route. Second, a substantial portion of the route has no local business and little potential to ever gain any. Third, the line has had expensive maintenance problems along the Salt

Lake and within the Feather River Canyon. The WP was never able to overcome these problems. Whether the UP will succeed remains to be seen.

Purchase of the WP was a strategic move to penetrate the California market dominated by the SP and the Santa Fe railroads. The UP has been able, via stack train business and the overall strength of its domestic service, to increase the number of trains using the route. No information is available about whether the route covers its costs within the UP system, however. Future growth in traffic appears to be most strongly tied to the economic interaction between the United States and the Pacific Rim countries.

The UP's purchase of the WP gave it the initial advantage of having a continuous through route (with partner Chicago and North Western) between Chicago and the west coast. The SP's Overland Route ended at Ogden. Recent moves by the SP, such as the purchase of a St. Louis-Chicago line, have in effect extended the Overland Route to Chicago also. The SP is now in a better competitive position.

Maintaining long parallel railroads in an area of thin traffic will become more difficult for both the SP and UP if current competitive trends continue. Both railroads have reportedly examined further establishment of joint track to reduce maintenance expenditures and boost traffic density. After the flooding of Salt Lake resulted in the closure of the SP's causeway, the company reportedly approached the UP about permanently operating over the Salt Lake City-Alazon portion of the old WP in exchange for UP operations over the SP Weso-Sacramento line. This would have eliminated the slide-prone Feather River Canyon tracks and the Salt Lake causeway, both of which are maintenance headaches. The UP refused this offer, principally because the Salt Lake was also flooding its line, and the construction activity necessary to raise the tracks above the rapidly rising lake limited train operations.

PART 2
NEVADA RAILROAD ACCIDENT CHARACTERIZATION

7 INTRODUCTION

Part 2 of this study is an expansion of the railroad data presented in the Preliminary Nevada Transportation Accident Characterization Study (DOE, 1990). The following material describes the accident characteristics of the Nevada rail system, presenting such information as types, causes, and frequency of railroad accidents; accident locations; types of rail accidents; and some of the more significant accidents occurring in the past 10 years. Several sources of information were used for this analysis: three different Federal Railway Administration (FRA) data bases — the Accident/Incident Data Base (FRA F 6180-54), the Rail-Highway Grade Crossing Accident/Incidents Data Base (FRA F 6180-57), and the Railroad Injury and Illness Summary (FRA F 6180-55a); the National Transportation Safety Board; and the Hazardous Material Incidents System (HMIS) maintained by the U.S. Department of Transportation's Research and Special Programs Administration.

The FRA Accident/Incident Data Base (FRA F 6180-54) provides the most comprehensive information, but to be entered into the data base an accident must cause more than an established threshold value in damage to the train, track, or track structures. This threshold value is now $5,200. This amount differs from the amount reported in Preliminary Nevada Transportation Accident Characterization Study because of recent adjustments for inflation.

The threshold value presents some difficulty in validating the data set. The General Accounting Office (GAO) has identified instances in which accidents were underreported by 8 to 43 percent because many of the railroads base their damage figures on initial field estimates prepared at the accident scene. More accurate repair estimates from repair shops were generally available within a day or two after the accidents, but the railroads' safety officers did not use these more accurate figures to determine if they should have reported. The findings of this study must be considered in light of this criticism of the data being used. For more information, the reader is directed to the referenced GAO report GAO (1989).

The FRA Rail-Highway Grade Crossing Accident/Incidents Data Base (FRA F 6180-57) captures all rail-highway grade crossing accidents involving railroad on-track equipment and a highway user, regardless of severity. By combining these two data FRA bases, a more comprehensive characterization of rail accidents in the United States and in the State of Nevada can be developed. A comparison of the number of rail-highway grade crossing accidents reported to the FRA between 1979 and 1988 to the number of such accidents in Nevada police files (Nevada Department of Transportation accident files) for the same period revealed 76 reported accidents in the police files and 110 accidents in the FRA data base. This could lead to the conclusion that the FRA rail-highway grade crossing accident data are fairly complete, perhaps significantly more so, in light of the discussion in the previous paragraph, than the rest of the FRA data. The different reporting criteria must be considered whenever a conclusion is drawn based on a combination of these two data sets.

A limited amount of data were drawn from the FRA Railroad Injury and Illness Summary (FRA F 6180-55a). This data base captures information on any event connected with the operation of a railroad that results in one or more of the following consequences:

- Death of a person within 365 calendar days of the accident/incident;
- Injury to a person, other than a railroad employee, that results in medical treatment;
- Injury to a railroad employee that results in medical treatment, restriction of work or motion for one or more work days, the loss of one or more work days, termination of employment, transfer to another job, or loss of consciousness;
- Any occupational illness of a railroad employee that is diagnosed by a physician.

Data were also obtained from the National Transportation Safety Board (NTSB) concerning all significant rail accidents investigated in Nevada since 1979. A synopsis of each of these accidents is presented in Appendix D, Accidents Investigated by the National Transportation Safety Board in Nevada (1979-1989).

The U.S. Department of Transportation's Research and Special Programs Administration maintains the HMIS, which also contributed to this study. More information is presented on this data base in Section 11.0, Hazardous Materials Accidents.

8 NEVADA ACCIDENT CHARACTERISTICS

Overview

With the exception of accident causes, the characteristics of rail accidents in Nevada are not markedly different from rail accident characteristics in of the rest of the nation. The most apparent differences seem to be related to the relatively large proportion of Nevada rail lines, compared to the nation as a whole, that are in open country where higher operating speeds are maintained. Most rail accidents, both in Nevada and in the United States, occur at very low speeds, which implies that many involve switching and various yard operations. Nevada shows a slightly higher number of high-speed accidents than does the national average. It also shows a larger percentage of its accidents caused by equipment failure and human factors.

One of the goals of this study was to identify high accident locations and provide information on "high-profile" accidents that have occurred on the Nevada rail system. The analysis showed that there are no classical high accident locations as there are with highway transport. Rather, minor accidents tend to occur in switchyards and during handling and routing operations. More severe accidents, occurring at higher speeds, may happen anywhere.

One exception to this statement is that rail-highway grade crossings, generically, represent a locus for rail accidents. Nevada has an active program to monitor rail-highway crossings to identify those crossings that should be prioritized for safety upgrades. This program has been effective enough to have eliminated the only significant problem location identified during the 10-year period. Nevertheless, because crossings represent a point of interaction between the rail system and general public, rail-highway grade crossing safety is examined in some detail.

Number and Types of Accidents

During the 10-year period from 1979 to 1988, the FRA Accident/Incident Data Base contained 208 rail accidents in Nevada and 48,256 for the entire United States. Figure 6 illustrates both a national and a Nevada trend toward fewer rail accidents. Only 23.1 percent of the reported Nevada rail accidents occurred during the last five years of the reporting period. In comparison, 44.7 percent of the Nevada

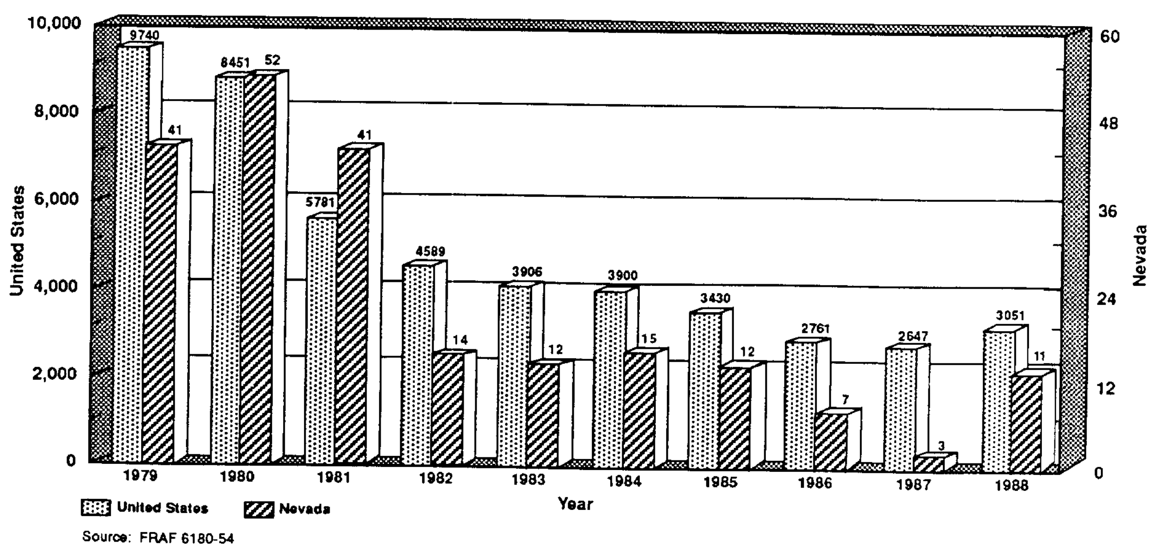

Figure 6 — Reported Rail Accidents in the United States and Nevada, 1979-1988

accidents occurred during 1979 and 1980, and more than three-fourths (76.9 percent) of the accidents occurred during the first five years, 1979 through 1983. The national data are generally consistent with the trend shown by the Nevada data, although the improvement is not as dramatic.

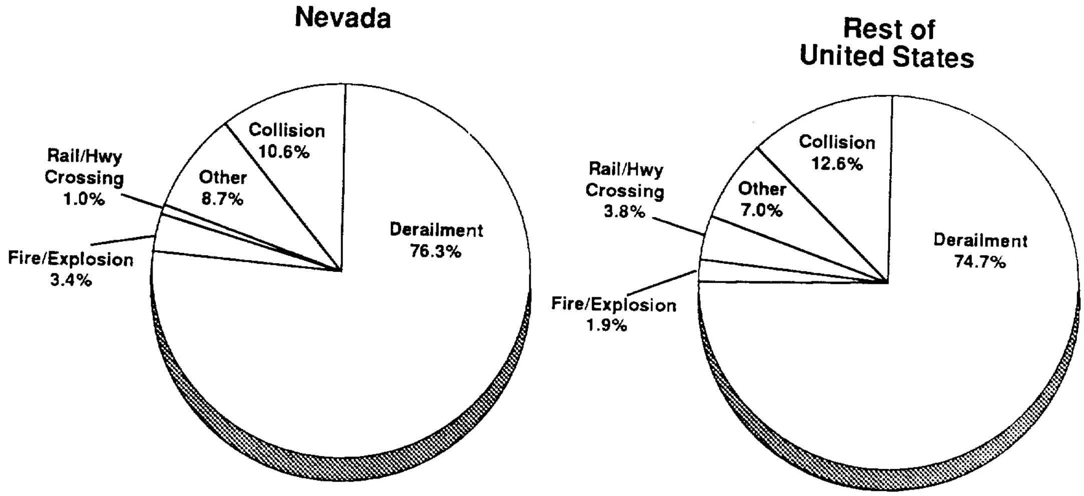

Figure 7 — Distribution of Rail Accidents by Types 1979-1988
Source: FRA F 6180-54

Types of accidents fall into five major classifications. Figure 7 shows the percentages of each accident type for Nevada and for the other 49 states as reported to FRA F 6180-54.

The most common accident type, both nationally and in Nevada, is *derailment*. An accident is classified as a derailment whenever on-track equipment leaves the rail for a reason other than a collision, explosion, or rail-highway crossing impact.

Collision accidents, the second most common type, occur when two trains or locomotives impact each other either head-on, in the rear, on the side, by raking, or at a crossing of two railroads. The FRA data include *obstruction* accidents, which are events in which a train strikes (1) a bumping post or foreign object on the track right-of-way, (2) a highway vehicle at a location other than a rail-highway crossing site, (3) derailed equipment, or (4) a track motorcar or similar work equipment not equipped with AAR couplers and not operating under train rules. Because *obstruction* accidents occur infrequently, they have been grouped with *collision* accidents for this study.

The data contain three other accident classifications, *rail/highway crossing*, *explosion/fire*, and *other*. *Explosion/fire* accidents are accidents that involve the detonation, combustion, or violent release of material transported by rail. The *other* category includes all other events not classified as one of the preceding types, and includes switching collisions when all cars involved are part of the switching movement.

Combining FRA's Accident/Incident Data Base with the Rail-Highway Crossing Data Base provides an additional perspective on rail accidents in the State of Nevada and the United States. Figure 8 shows that nationally *rail-highway grade crossing* accidents are, by far, the most likely type of accident to occur, comprising 62.8 percent of all reported accidents. However, when Nevada is examined, *derailments* remain the most likely type of accident to occur (50.3 percent of all accidents). *Rail-highway grade crossing* accidents are second at 34.8 percent. Two points emerge when rail-highway grade crossings are considered: first, the relative importance of this type of accident when compared with all other types;

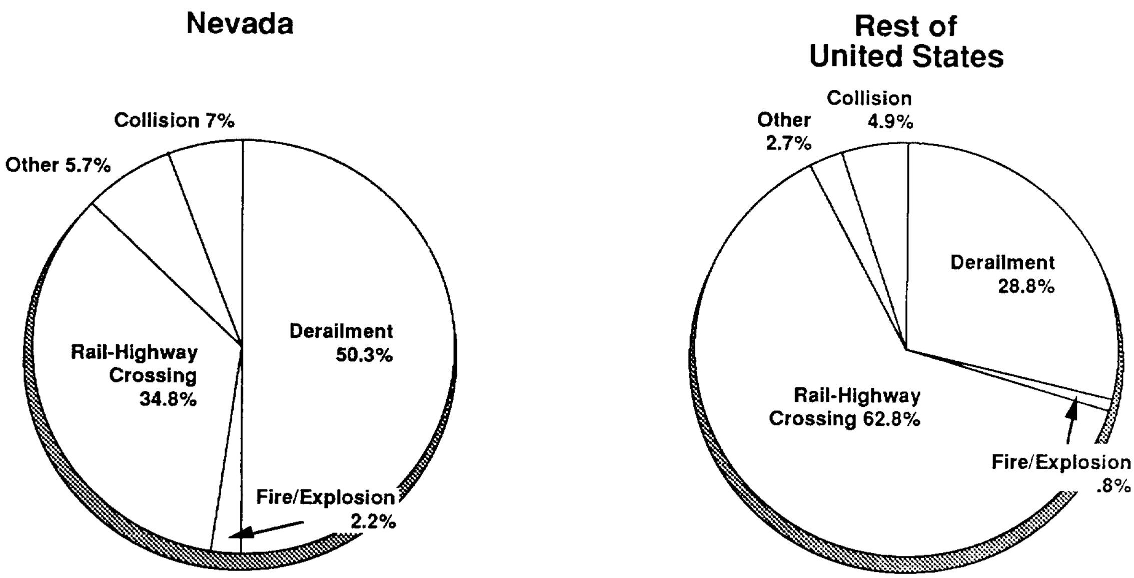

Figure 8 — Distribution of All Rail Accidents by Type 1979-1988
Source: FRA F 6180-54 and FRA F 6180-57

and second, the dramatic difference between Nevada and the rest of the United States in the relative contribution of *rail-highway grade crossing* accidents to the overall mix of accidents. In evaluating the overall contribution of rail-highway accidents, it is important to remember that this type of accident may be more completely reported to the FRA than the other types of accidents, as was mentioned earlier.

Causes of Rail Accidents

The causes of accidents were first examined using FRA F 6180-54. In this study, accident causes were grouped into four major classifications. The first classification, *track/roadbed*, includes accidents caused by track, roadbed, or structures. Representative causes include defective track geometry, rail and joint bar problems, damaged switches, switches out of adjustment, and improperly operating signal and control systems. The second category, *mechanical/electrical*, covers accidents caused by malfunction of some part of the train, including brakes, body parts, the coupler and draft system, truck components, axles and journal bearings, wheels, and locomotive failures. The third category, *human factors*, includes accidents resulting from the improper use of brakes, an employee's physical condition, improper signalling or response to signalling, failure to comply with operating procedures, excessive speed, and improper use of switches. The fourth classification is *miscellaneous*. This includes accidents caused by events not covered in the other three categories, such as collision with a highway user at a rail-highway crossing (in the FRA F 6180-54 data base); signal failures; vandalism; shifting load; load falling from car; objects on or fouling the track; snow, ice, or mud on the track; other acts of God; and improperly loaded cars.

Figure 9 shows the proportion of accidents attributed to each category. The national and Nevada data differ in this classification. During the 10-year period being examined, the two most common causes of rail accidents in Nevada were *mechanical/electrical* and *human factors*, each of which accounted for 39.4 percent and 30.3 percent, respectively, of the total accidents. The other approximately one-third of the accidents were divided between *miscellaneous* (14.4 percent) and *track/roadbed* (15.9 percent). These data indicate that the most likely cause of a train accident in Nevada will be either a mechanical failure of some part of the train itself, or improper operation of the train.

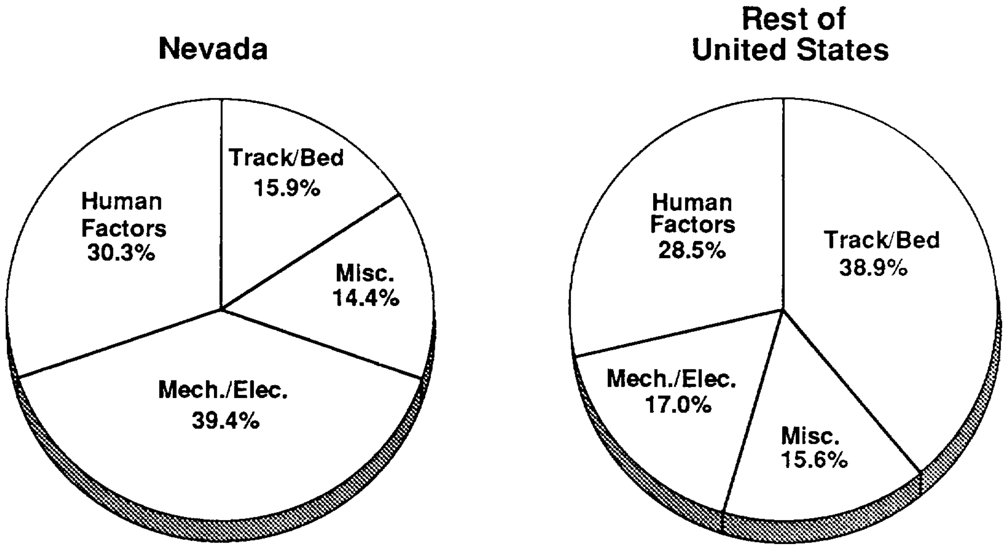

Figure 9 — Causes of Rail Accidents Reported 1979-1988
Source: FRA F 6180-54

In contrast, nationwide data show that 38.9 percent of all accidents are attributed to *track/roadbed*. *Human factors* is second with 28.5 percent, while *mechanical/electrical* is third, at 17.0 percent. *Miscellaneous* is the least common cause at 15.6 percent. In Nevada, *mechanical/electrical* causes are twice as likely to be responsible for accidents as in the other 49 states.

The data reflect that proportionately more accidents are caused by *track/roadbed* conditions in the United States than in Nevada, and proportionately more accidents are caused by *mechanical/electrical* failure in Nevada than in the rest of the nation. Both these conditions would seem to be consistent with the fact that Nevada has a well-maintained system with a larger proportion of its track in open country than the nation in general. A detailed comparison of Nevada's mechanically and electrically caused accidents shows a higher percentage of wheel failure and journal bearings failures. Failures of other truck components included side bearings, hubs, bolsters, and center pins—factors aggravated by higher speed operation. Comparison of the data on accident frequency at different speeds in Nevada and in the United States appears to support this theory. Nevada shows a higher proportion of its reported accidents in the higher speed ranges than does the rest of the nation.

Table 1
Distributions of Causes of Reportable Rail Accidents 1979-1988

Causes	With FRA F 6180-57 Nevada	With FRA F 6180-57 U.S.	Without FRA F 6180-57 Nevada	Without FRA F 6180-57 U.S.
Human Factors	19.9%	11.0%	30.3%	28.5%
Track and Roadbed	10.4%	15.1%	15.9%	38.9%
Mechanical/Electrical	26.0%	6.6%	39.4%	17.0%
Miscellaneous	9.5%	5.9%	14.4%	15.6%
Rail-Highway Grade Crossings	34.2%	61.4%	–	–

Source: FRA F 6180-54 & FRA F 6180-57

When FRA F 6180-54 and FRA F 6180-57 are combined, the information on the causes of accidents remains consistent. Rather than attempt to assign a cause to a rail-highway grade crossing accident (a difficult or impossible task), the FRA simply categorizes a rail-highway grade crossing accident as its own cause. The distribution of the causes of rail accidents, after combining the two data bases, is presented in Table 1.

Speeds at Times of Accidents

Most rail accidents happen at very low speeds. Figure 10 shows a breakdown of accident percentages by speed range. Almost half of all reported accidents in Nevada (49.7 percent) occurred at speeds of 10 mph or less, and 39.5 percent of all accidents in the state were at 5 mph or less. On a national basis, 72.5 percent of all accidents occur at 10 mph or less, and 52.8 percent of all rail accidents occur at 5 mph or less. These speeds are indicative of freight yard switching and branchline operations, where track is generally less well-maintained than on mainlines. Switching operations, with the coupling and uncoupling of cars, frequent changes in direction, and movement through turnouts, seem to offer higher potential for reportable accidents than do mainline train movements. These accidents may, however, be of lower severity than are accidents occurring in mainline operation.

The frequency of accidents in the higher speed ranges in Nevada is a little greater than in the rest of the United States. This difference is probably due to the larger proportions of open track in Nevada and the resulting higher average train speeds and lower number of switching activities. The severity of accidents increases at higher train speeds, especially when collisions occur.

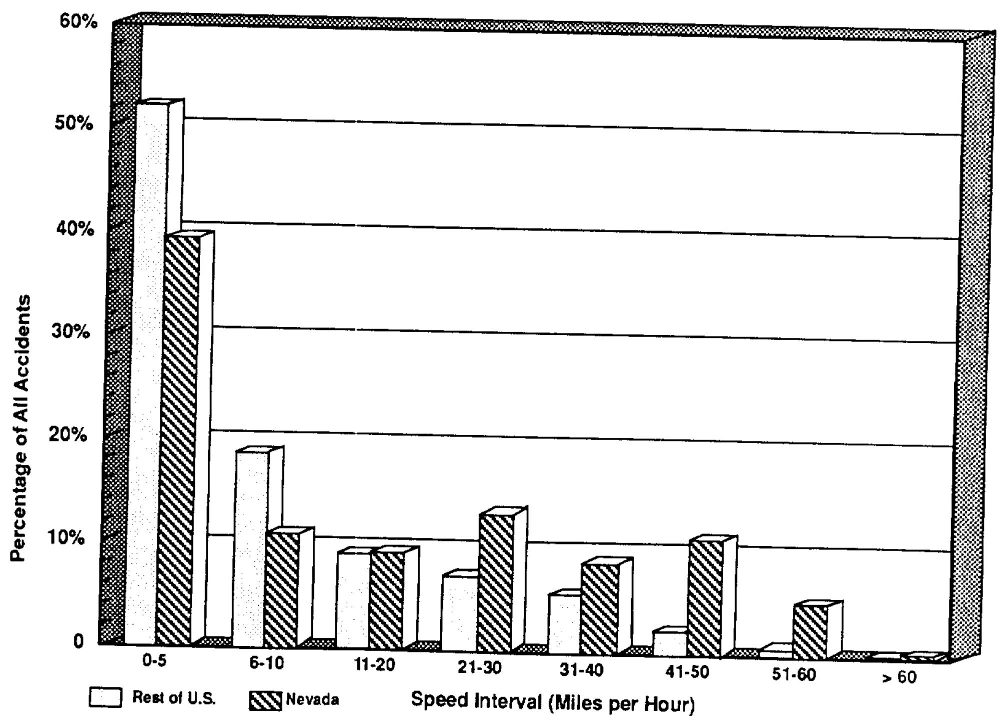

Figure 10 — Percentage of Rail Accidents by Speed Interval 1979-1988
Source: FRA F 6180-54

Elapsed Time on Duty

Figure 11 shows the distribution of time on duty for engineers and conductors involved in accidents. It might be expected that accidents would tend to be more prevalent when hours of service are high because of employee fatigue. The data seem to indicate, however, that elapsed time on duty follows no trends. Both occupations show similar figures; neither has a very dramatic change in accident rates. The charts show that about 45 percent of all accidents happen in the first 4 hours, about 41 percent happen between 4 and 8 hours, and about 14 percent happen after 8 hours. When human factors accidents are selected and analyzed (to test the hypothesis that accidents caused by human error will increase over time), the results are virtually identical.

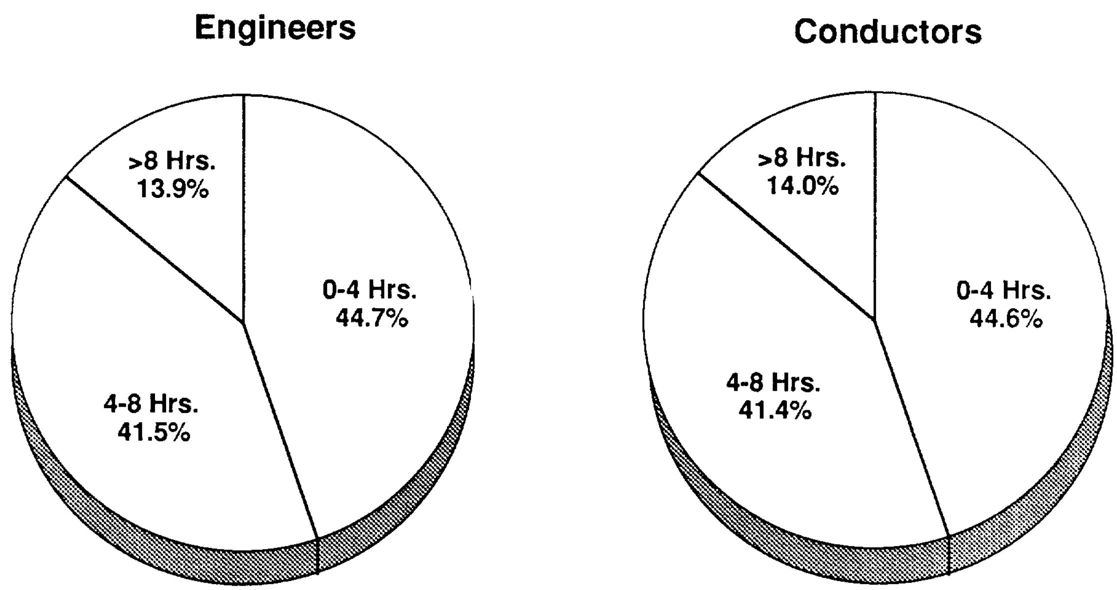

Figure 11 — Time on Duty at Rail Accidents - United States 1979-1988
Source: FRA F 6180-54

Weather and Time of Day

In Nevada, almost three-fourths (73.0 percent) of all accidents reported in the data occurred in clear weather, while 19.3 percent occurred in cloudy weather. Rain, fog, and snow account for lower proportions. Figure 12 shows the percentages. Generally, weather does not seem to be a major factor in rail accidents either in Nevada or the nation.

In Nevada, about half (49.2 percent) of all rail accidents occurred after dark. The day and night proportion is reversed for national data — 42.1 percent of all accidents occurred at night. Unlike highway operations, rail operations have no general temporal patterns; operations usually occur around the clock. Signalling practices and the presence of multiple crew members in the operating cab may tend to negate factors that lead to increased accident frequencies during nighttime highway operations. Figure 13 shows a breakdown of accident percentages by the general time of day.

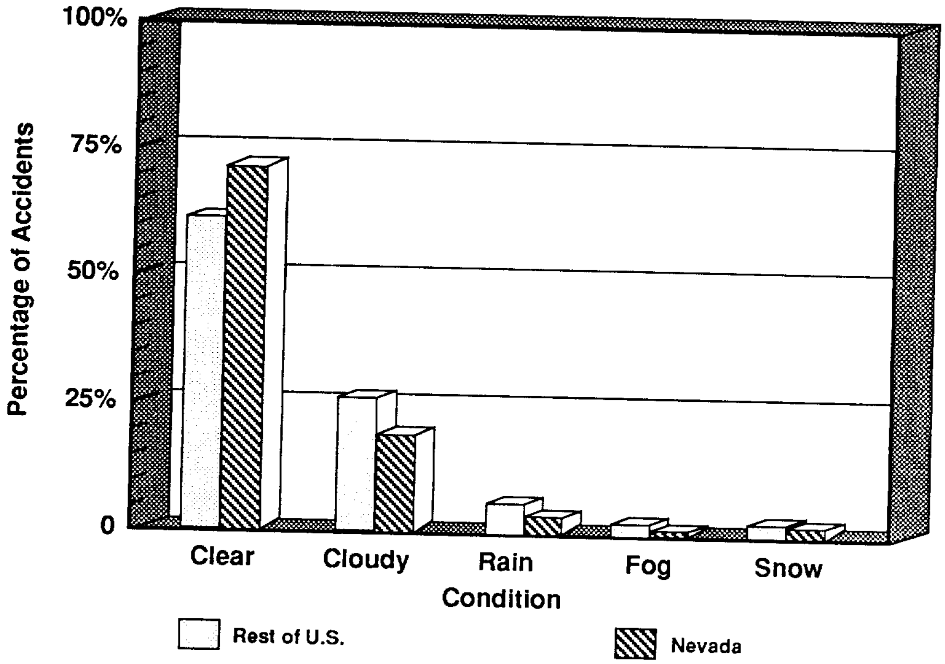

Figure 12 — Weather at Time of Rail Accidents - U.S. & Nevada
Source: FRA F 6180-54

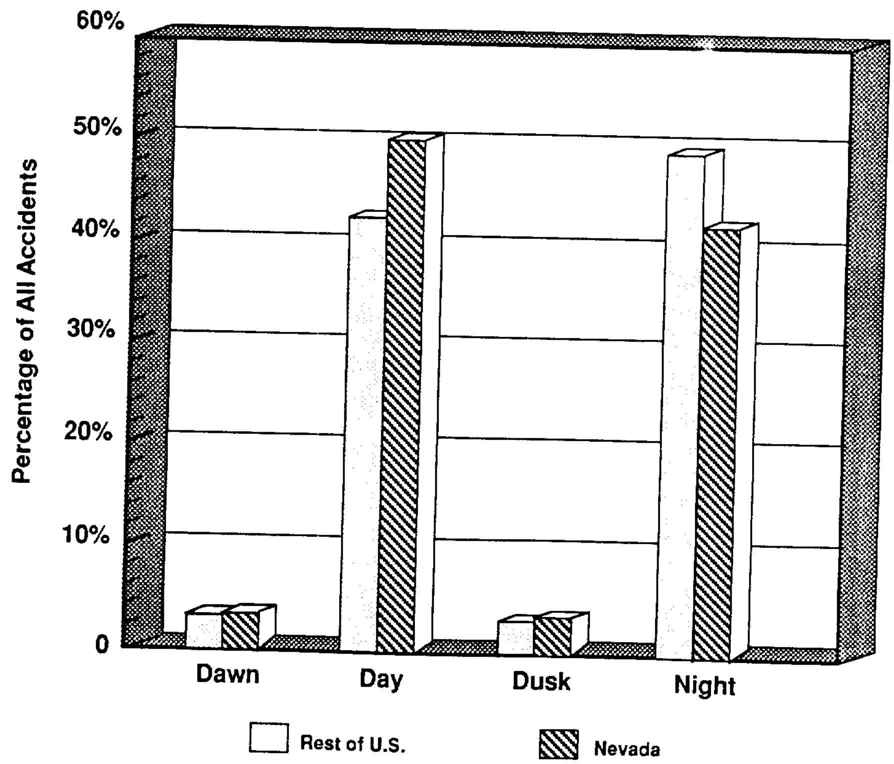

Figure 13 — Time of Day of Rail Accidents 1979-1988
Source: FRA F 6180-54

Locations of Accidents in Nevada

Attempts to identify high accident locations in Nevada were only partially successful. Analysis of all accident locations (FRA F 6180-54 and -57) indicates that location is a fairly random variable. Analysis of the locations by type of track showed that accidents happening on switchyard tracks occurred in 13 locations and accounted for 62 accidents, or 20.5 percent of all rail accidents reported in Nevada (303 accidents had locations reported). Furthermore, when accidents occurring on mainlines, sidings, and industrial spurs in these 13 locations are included, the total increases to 149 accidents (49.2 percent). Table 2 presents the information on these 13 locations and the types of tracks on which accidents have occurred. The other 154 reported accidents are widely distributed among 87 sites.

Table 2
Locations and Distribution of All Accidents in Nevada at Locations Reporting Switchyard Accidents, 1979-88

	TYPE OF TRACK				
Location	Yard	Main	Siding	Industry	Total
Boulder Jct.	1	1		1	3
Caliente	1	1	1		3
Carlin	7	8		1	16
Elko	19	21	2	1	43
Gerlach	1	1			2
Hazen	1	1			2
Henderson	3	1		2	6
Las Vegas	11	3	1	3	18
Mina	1				1
Palisade	1	1	1		3
Reno	2	17		2	21
Sparks	11	9		6	26
Winnemucca	3		2		5
Total	62	64	7	16	149

Source: FRA F 6180-54 & FRA F 6180-57

Figure 14 shows the stations most commonly listed as closest to reported rail accidents in FRA F 6180-54. The figure also gives the number of accidents (in parentheses) occurring near that location during the 1979-1988 reporting period. Not all accident locations are shown in the figure, but the most significant ones are. The most common stations listed as closest to an accident are Carlin and Sparks (14 accidents each), Elko (11 accidents), and Las Vegas (10 accidents). Sparks, Las Vegas, and Elko all have heavy switching activity. This seems to lend credence to the hypothesis that the frequency of accidents at low speeds correlates with switching movements. Carlin is a crew change point. Note that a number of locations (designated by RR) are railroad stations, not necessarily population centers.

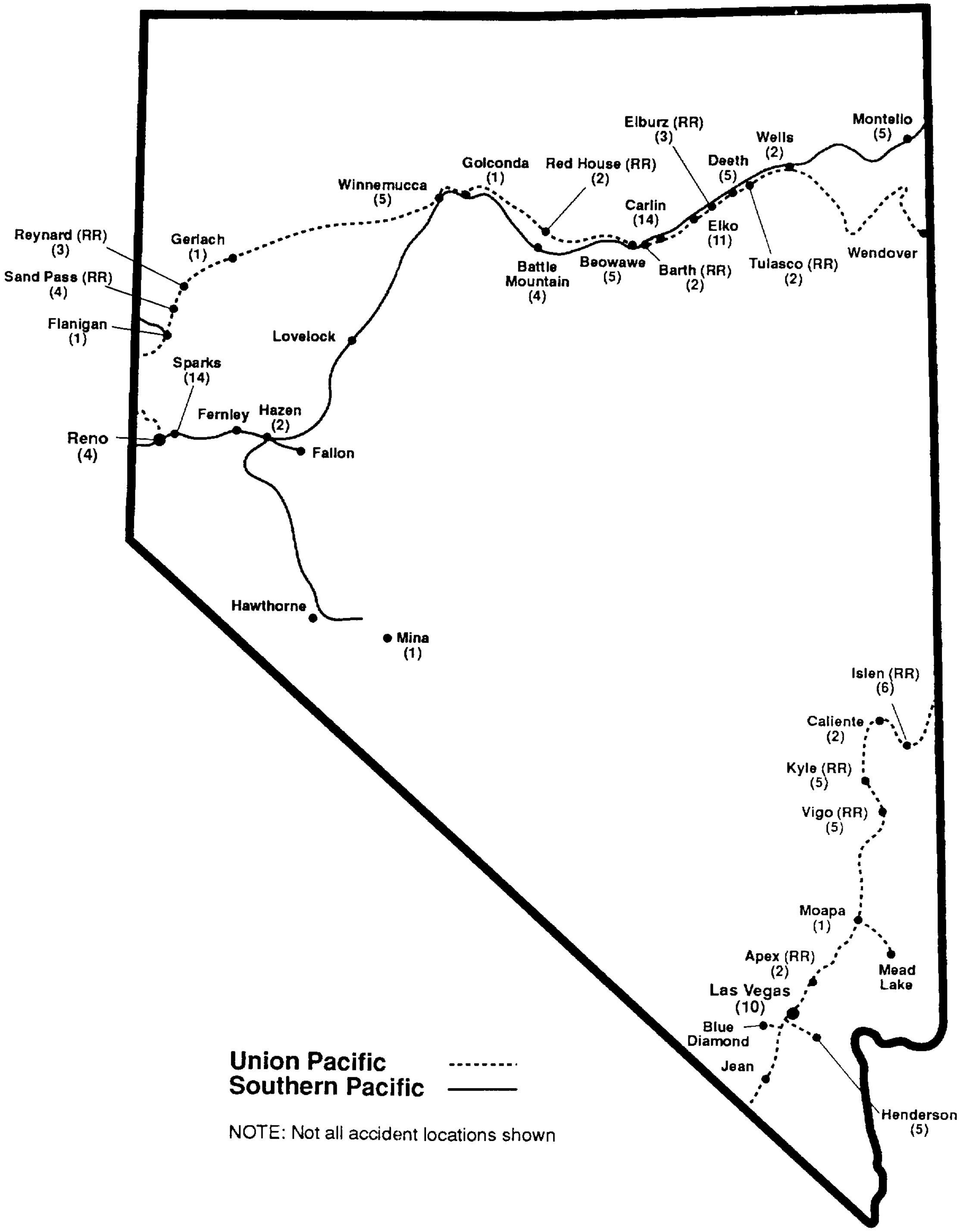

Figure 14 — Locations of Accidents
Source: FRA F 6180-54

9 RAIL-HIGHWAY GRADE CROSSING ACCIDENTS

Generally, once switching and handling incidents are eliminated, rail accidents seem to occur at random locations. The notable exception to this statement is rail-highway at-grade crossings. Nevada has 348 at-grade public crossings, 87 grade-separated crossings, 284 at-grade private crossings, and 2 pedestrian-only crossings for a total of 721 rail-highway crossings.

Railroad grade crossings with other surface modes (highway, pedestrian, bicycle, etc.) are potential accident locations. Nationally, rail-highway crossings are a high accident location. Trains cannot easily stop to avoid collisions with vehicles at grade crossings. The encroaching vehicle or pedestrian often does not expect the train at the crossing. Even when safety features such as lights and crossing gates are in place, accidents are not completely eliminated. A portion of the driver population will not respect the devices. The only sure way to eliminate grade crossing accidents is to make the crossing grade-separated.

The results of a crossing accident are almost always severe for the pedestrian or encroaching highway vehicle. Even slow-moving trains exert tremendous physical forces that no highway vehicle can withstand. Automobiles are often destroyed, and trains usually suffer little damage. Heavy trucks are also rather fragile, but their cargo can be extremely damaging to the train. Train crews have a horror of tank trucks containing flammable materials and of trucks loaded with heavy materials (e.g., sand, aggregate, logs, and other bulk materials) because such trucks can cause severe physical damage to the locomotives during a collision.

Another potential danger in grade crossing collisions is derailment. The train engineer usually applies the emergency brake when a collision appears to be imminent. The resulting extreme forces within the train can cause a jackknifing action under certain circumstances of train consist, track geometry, and speed. The consequences of a train derailment can be worse than the actual collision with the highway vehicle.

During the period from 1979 to 1988, there have been 110 accidents reported at Nevada rail-highway grade crossings according to the FRA's Rail-Highway Grade Crossing Accident Data Base (FRA F 6180-57). These accidents resulted in 34 injuries and 12 fatalities. The injuries occurred in 26 accidents and the fatalities in 8 accidents. One rail-highway crossing accident resulted in both a fatality and two injuries. The results of rail-highway accidents in Nevada are shown in Table 3.

Table 3
Results of Rail-Highway Grade Crossing Accidents in Nevada, 1979-1988

Results of Accident	No. of Accidents
Property Damage Only	77
Injuries	25
Fatalities	7
Injuries and Fatality	1
Total	110

Source: FRA F 6180-57

Table 4 presents and compares annual figures for the number of rail-highway crossing accidents in Nevada and the other 49 states. Both sets of data show a general downward trend in the number of accidents and the number of fatalities, although the number of fatalities in Nevada is low enough that there could be a strong random element present.

Table 4
Rail-Highway Grade Crossing Accidents 1979-1988

	Rest of U.S.		Nevada	
Year of Accidents	Number of Accidents	Number of Fatalities	Number of Accidents	Number of Fatalities
1979	12,482	882	27	1
1980	10,588	832	23	1
1981	9,258	728	10	0
1982	7,739	602	9	5
1983	7,145	572	16	3
1984	7,276	649	5	0
1985	6,912	581	7	1
1986	6,390	616	6	0
1987	6,387	623	4	0
1988	6,612	687	3	1
Total	80,789	6,772	110	12

Source: FRA F 6180-57

Further comparison of national rail-highway grade crossing accidents to Nevada rail-highway grade crossing accidents shows little difference. Table 5 presents the type of highway vehicle involved, the weather, and the visibility at the time of the rail-highway accidents. The only notable difference is the mix between automobiles and single-unit trucks. Nevada shows significantly fewer automobiles and more trucks than the rest of the nation. However, this difference may be in line with the total vehicle mix for Nevada compared to the rest of the nation. Rail-highway accidents occurring at night are a slightly more significant proportion of the total accidents in Nevada than in the rest of the nation. Table 5 also presents information on the weather at the time of rail-highway crossing accidents. Again, the differences are insignificant.

Examination of the most dangerous crossings since 1979 reveals that Elko was the location of a large number of accidents. However, a track relocation program in Elko removed numerous urban crossings, virtually eliminating rail-highway crossing accidents in that area for the last five years of the period being examined (1984-1988).

During the same five-year period, three Reno crossings have had three accidents each. They are the Virginia Street, Sage Street, and North Highway 395 crossings. The Virginia Street crossing has had four accidents since 1979, with one fatality. One other crossing in the state, the Dresser Mill Crossing, a private crossing near Battle Mountain, has had two accidents. One of those accidents (occurring on October 17, 1983) killed two people. No other crossing has had more than one accident in the last five years of the data set. For the 1984-1988 period, the North Highway 395 crossing in Reno is the only crossing at which more than one injury has occurred. Three people were injured in two different accidents at this crossing. It should be noted that only 98 rail-highway crossing accidents in the data base had the grade crossing identification number field filled in. For the other 12 accidents no location was assigned.

Craig Road crossing in Clarke County stands out as the site of a particularly bad accident. On January 16, 1982, an Amtrak train travelling 79 mph through the crossing was struck on the second of two locomotives by a truck going an estimated 55 mph. All four occupants of the truck were killed. The accident occurred at about 8:50 PM, the weather was clear, and the driver drove around the safety gates at the crossing. There were no injuries to anyone on the train.

Table 5
Percentage Distribution of Circumstances
of Rail-Highway Grade Crossing Accidents 1979-1988

TYPE OF VEHICLE INVOLVED

	Auto	Truck	Truck/Trailer	Other
Nevada	47.3	33.6	10.9	8.2
Rest of U.S.	64.3	22.3	8.3	5.1

WEATHER

	Clear	Cloudy	Rain	Fog	Sleet	Snow
Nevada	73.6	17.3	6.4	–	–	2.7
Rest of U.S.	64.5	22.0	8.3	1.9	.3	3.0

TIME OF DAY

	Dawn	Day	Dusk	Dark
Nevada	.9	50.9	2.7	45.5
Rest of U.S.	2.4	54.8	3.4	39.4

Source: FRA F 6180-57

10 CASUALTIES OF NEVADA RAILROAD ACCIDENTS

Injury-Producing Rail Accidents

During the 1979-1988 period in Nevada, a total of 15 accidents in which 36 people were injured were reported to the FRA Accident/Incident Data Base (FRA F 6180-54). This is a rather small data set, so conclusions regarding injury-producing accidents in Nevada must be tentative. In the rest of the nation, 1,810 injury-producing accidents were reported during the same period. This size data set provides more validity for conclusions. Figure 15 shows a breakdown of these accidents by cause.

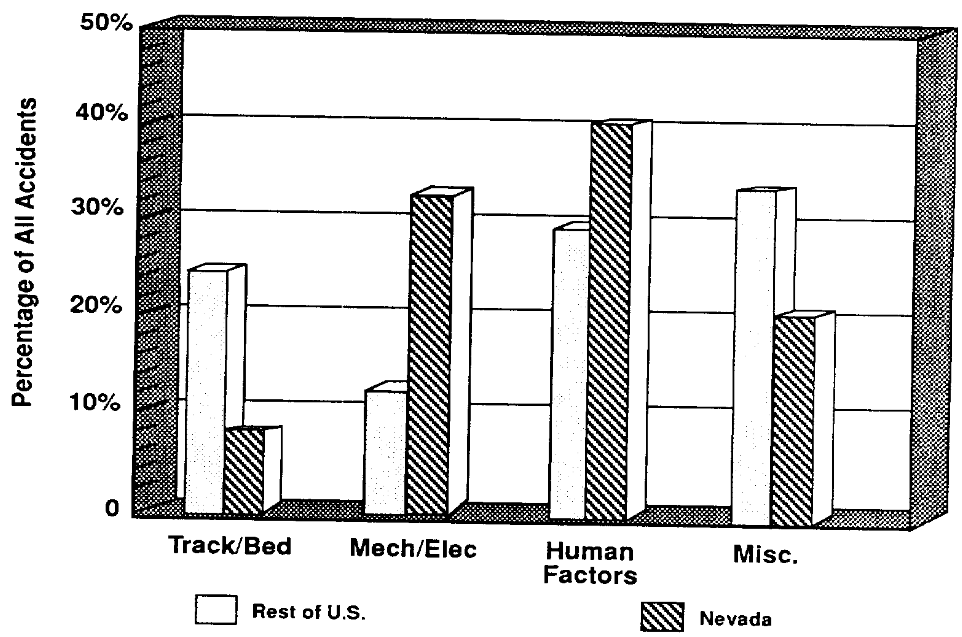

Figure 15 — Causes of Injury-Producing Rail Accidents 1979-1988
Source: FRA F 6180-54

The causes of injury-producing accidents are fairly consistent with the causes of all accidents reported earlier in this section. As indicated in Figure 15, Nevada and the rest of the United States show a marked difference: human factors and mechanical/electrical problems caused 40 percent and 33 percent, respectively, of Nevada's injury-producing accidents. This is consistent with information presented in Section 8, which discussed the differences in Nevada and national rail accident causes.

The types of injury-producing rail accidents (accidents classified as described on page II-4), shown in Figure 16, are somewhat different in Nevada than in the rest of the nation. In the rest of the United States, 36.2 percent of injury-producing accidents were derailments and 24.2 percent were collisions. In Nevada, the relative rankings are reversed — 40 percent derailment and 53.3 percent collision. Nationally, rail-highway crossings account for 30.7 percent of all injury-producing accidents, but such crossings account for only 6.7 percent of all injury-producing accidents. The differences could be related to the relatively small data set in Nevada, or they may be a result of the more open spaces in Nevada.

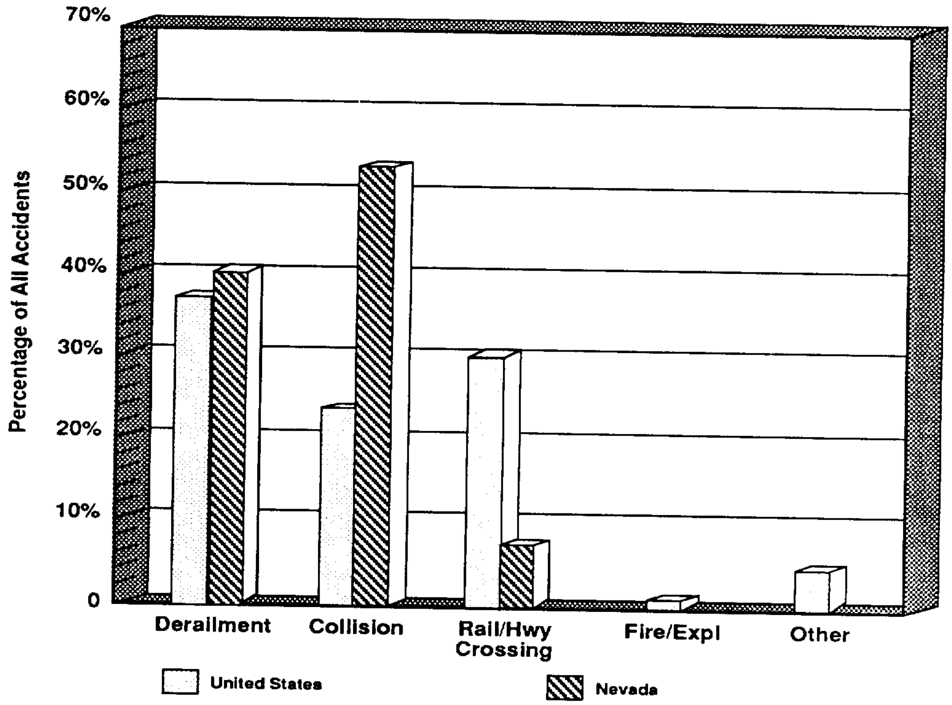

Figure 16 — Types of Injury-Producing Rail Accidents 1979-1988
Source: FRA F 6180-54

The severity of injury-producing accidents in Nevada ranges from one to ten people being injured. Six accidents resulted in one person being injured. Six more of the 15 injury-producing accidents resulted in two people being injured, and three of the accidents injured 3, 5, and 10 people each.

In Nevada, collisions injured 21 people over the past ten years. This equals 58.3 percent of all injuries. Derailment caused 36.1 percent of all injuries in Nevada, while rail-highway crossing accidents caused 5.6 percent.

Fatal Rail Accidents

Nevada had only three fatal rail accidents reported in the FRA F 6180-54 Data Base for the ten years being examined. In these three accidents, four people lost their lives. All three fatal accidents happened during clear weather and after dark. The cause of two of the accidents was attributed to human factors, and one was the result of a rail-highway crossing collision. Concerning the type of fatal accidents, one was listed as a collision, one was a rail-highway crossing accident, and the other was listed as other. The cause of the three accidents is interesting (though the sample size is too small to be statistically significant) because only 30.3 percent of the accidents reported in Nevada were attributed to human factors.

The national data report a total of 488 accidents in which one or more people were killed. This larger sample size bears some scrutiny. The statistics for fatal accidents related to speed are interesting. Figure 17 shows the proportion of fatal accidents occurring in each speed interval for the nation, but this is not a complete picture. Significantly fewer accidents occur at the higher speeds, but the chance that an accident, once it occurs, will produce a fatality increases dramatically as speed increases. By comparing the total number of accidents at each speed interval to the total number of fatal accidents at each speed interval, it becomes clear that an accident occurring above 60 mph is 31 times more likely to cause a fatality than an accident occurring at 5 mph or less. The odds of an accident causing a fatality increase steadily as speed at the time of the accident

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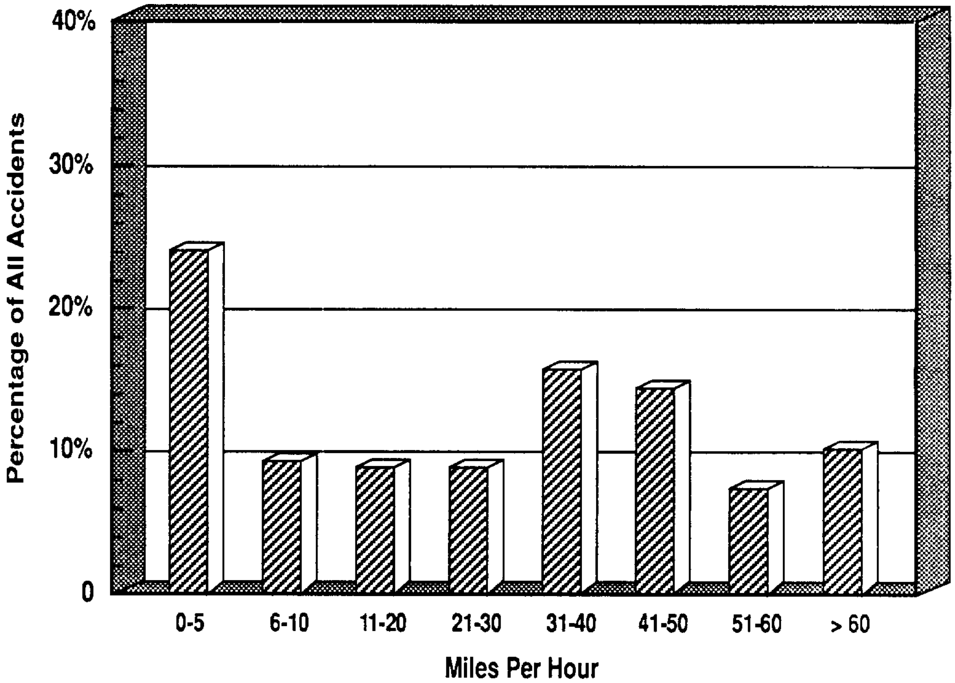

Figure 17 — Speeds During Fatal Rail Accidents - United States 1979-1988
Source: FRA F 6180-54

increases.

When injuries or fatalities are considered, the data contained in the FRA Railroad Injury and Illness Summary Data Base are more complete than the previously cited data. Regardless of damages incurred, railroads must report any event connected with the operation of a railroad that results in one or more of the following consequences:

- Death of a person within 365 days of the accident/incident;
- Injury to a person, other than a railroad employee, that results in medical treatment;
- Injury to a railroad employee that results in medical treatment, restriction of work or motion for one or more work days, the loss of one or more work days, termination of employment, transfer to another job, or loss of consciousness; or
- Any occupational illness of a railroad employee that is diagnosed by a physician.

Analysis of this data base provides a more complete picture of Nevada's rail safety situation because there is no property damage reporting threshold as there is for the previously used Accident/Incident data set.

Between 1979 and 1988, there were 39 fatalities reported in connection with the operation of railroads in Nevada (see Table 6). Of these 39 reported fatalities, 12 were the result of rail-highway crossing accidents. These 12 fatalities occurred in eight different accidents. All the other fatalities were either to railroad employees, or to trespassers on railroad property. There were 18 fatalities resulting from a person being struck by, or running into, a locomotive or cars at places other than rail-highway crossings. All these fatalities were trespassers who were generally walking along the tracks, passing under or through train cars, or sitting or lying on tracks. Three railroad employees have been killed during the period being examined. One was killed on June 22, 1985, in a rear-end collision of two trains, and the other two were killed in an accident that happened on September 12, 1981, and resulted from excessive coupling speed. The fatal accident resulting from the rear-end collision was investigated by the National Transportation Safety Board and is described in Appendix D as Accident 12.

Table 6
Causes of Rail Fatalities in Nevada 1979-1988

Circumstances	No. of Fatalities	No. of Trespassers
Getting On or Off Cars or Locomotives	1	1
Rail/Highway Crossing	12	*4
Other Rail Equipment Accidents	4	1
Struck by or Ran into Consist at Places Other Than Rail-Highway Crossings	18	18
Miscellaneous	4	3
Totals	39	27

*** The FRA defines as trespassers any persons on a rail-highway crossing that is protected by gates or similar barriers, or any persons attempting to pass over, under, or between the cars of a consist occupying a crossing.**

Source: FRA F 6180-55

11 HAZARDOUS MATERIALS ACCIDENTS

Accidents in Nevada involving the release of hazardous materials were examined. Two sources of information were used: the FRA Accident/Incident Data Base (FRA F 6180-54), which has (1) information on the number of cars carrying hazardous materials and (2) information about whether there were any releases; and the HMIS, which is maintained by the Department of Transportation (DOT) Research and Special Programs Administration (RSPA) and is reported on the DOT Incident Report Form F 5800.1. Appendix C contains a tabular presentation of the Nevada incidents in the HMIS.

The HMIS is the only data base developed specifically for recording spills of hazardous materials during transportation. Reporting is required if one of the following circumstances occurs as the direct result of the hazardous material being released:

- A person is killed or hospitalized,
- Estimated carrier or property damage is in excess of $50,000,
- The general public is evacuated for one or more hours,
- One or more major transportation arteries or facilities is closed or shut down for one hour or more, or
- The operation or flight plan or routine of an aircraft is altered.

Every release meeting one or more of the criteria, except for those from bulk water transporters and those motor carrier firms doing only intrastate business, must be reported to the RSPA in writing as prescribed in Title 49 of the Code of Federal regulations. These data are self-reported by the carriers and may not be complete. Furthermore, there are no data from operators in the trucking industry, who are not subject to the Federal Regulations requiring report age to the RSPA. When reviewing the HMIS data, it is important to consider the reporting criteria mentioned above. Damages, deaths, and facility delays/alterations that occurred as a result of the accident must have been a *direct result* of the hazardous materials released in order for the accident to be reported to the RSPA.

The HMIS was queried to obtain all reported rail hazardous materials incidents from 1979 to the present. There were a total of 35 incidents in the data base meeting these search conditions, and four of these incidents were due to a vehicular accident. Total financial damages were listed at $290,060 for the 35 incidents, and $102,500 of that amount resulted from the four. Appendix 2 contains an abbreviated listing of all 35 Nevada incidents in the HMIS. There were no evacuations reported, but it should be noted that this was not a field on the DOT Incident Report Form F 5800.1 until January 1990. The locations of the four accidents reported in the HMIS are Elburz, Henderson, Sparks, and Mill City. No details are provided concerning the nature of the accidents, although no injuries or fatalities were reported. Considering the 35 incidents in which a hazardous material was spilled and reported to the HMIS, three locations stand out. Las Vegas is listed as the location for ten of the 35 incidents, Sparks is listed for seven, and Henderson is the location of four. No other location appears more than once. These findings are not unexpected. Although there is no field in the data base for describing the circumstances of how the spills were discovered, most spills are probably discovered during switching and handling operations, and the three locations listed are sites of switchyards.

The data show that nine of the 35 incidents involved spills of sulfuric acid, six incidents involved hydrochloric acid, and four incidents involved liquefied petroleum gas (LPG). Other substances were reported only once or twice. The causes of the incidents reported before January 1, 1990, were not listed in detail. Four causes of these spills were identified — *accident/derailment, human error, package failure,* and *not available*. Twenty-two of the incidents were caused by *package failure*. Eight were caused by *human error*, and four resulted from *accident/derailment*. One accident was listed as *not available*. These data indicate a far greater likelihood for a hazardous material spill from failure of the package, than from an incident resulting from or related to railroad operations.

The Accident/Incident Data Base (FRA F 6180-54) reports that 11 accidents involving trains transporting hazardous materials occurred in Nevada between 1979 and 1988. Comparing these accidents to the 208 total Nevada accidents reported in the data base (which does not include all accidents during the period of interest) indicates that 5.3 percent of the accidents reported in Nevada involved consists carrying hazardous materials. The national data show that 4,683 accidents involving trains with hazardous materials occurred in the rest of the United States out of a total of 48,048 accidents reported. This means that 9.7 percent of all accidents reported involved, hazardous materials. Historically train accidents in Nevada have been somewhat less likely to involve hazardous materials than train accidents in the rest of the United States.

Further analysis shows that of the 11 reported accidents in Nevada, only two involved the actual release of any hazardous material. This is a very small sample size, but it indicates there is a .96 percent probability that any reportable rail accident will involve release of a hazardous material. For the rest of the United States, the data indicate an overall probability of 1.28 percent.

The Nevada accidents that released hazardous materials occurred on December 7, 1981, near Elburz and on August 20, 1986, near Mill City. Both accidents were derailments caused by the mechanical failure of a car wheel. The Elburz accident is reported in the HMIS to have been a spill of 1,600 gallons of hydrochloric acid bound for Salt Lake City, Utah. No injuries, fatalities, fires, or explosions were reported. This accident resulted in the evacuation of 30 people according to FRA F 6180-54. The Mill City accident was a spill of 20,822 gallons of alcoholic beverage. There were no injuries or fatalities, but there was a fire and 20 people were reportedly evacuated. This accident was investigated by the National Transportation Safety Board and is reported as Accident 13 in Appendix D.

12 NATIONAL TRANSPORTATION SAFETY BOARD INVESTIGATIONS

To support the development of better regulations and safety standards, the National Transportation Safety Board (NTSB) investigates accidents that occur regardless of mode of transportation. The NTSB investigates rail accidents that meet one or more of the following criteria:

- Cause more than $500,000 damage,
- Involve a passenger train, or
- Involve the release of hazardous materials.

These criteria are, however, applied very loosely, allowing the NTSB wide latitude in deciding which accidents should be investigated. One final criterion is whether an investigative team is available at the time of the accident. Between 1979 and 1988, the NTSB investigated 17 rail accidents/incidents in Nevada. Only 15 of these reports were available from the NTSB. In addition to the 15 completed reports acquired from the NTSB, two preliminary reports for accidents that occurred during 1989 were acquired. These two preliminary reports are described at the end of this section.

Of the 15 incidents described in detail, 13 were derailments, one was a rear-end collision between two trains, and one was a hazardous material spill. The 15 accidents resulted in one fatality and ten injuries. Locations of the investigated accidents are presented in Figure 18.

Numbers presented in the figure are keyed to the accident numbers in Appendix D. Examination of the figure indicates that the location of NTSB-investigated accidents are widely dispersed throughout the state. Some accidents that the NTSB investigated prior to 1982 are not included in this study because, before that time, any accident or incident involving the death of a trespasser on rail property was investigated. This requirement was dropped in 1981. For the sake of consistency, and to focus on rail accidents specifically, these pre-1982 incidents were eliminated.

Table 7 presents summary information on the NTSB-investigated accidents. More detailed information is provided on each accident in Appendix D — National Transportation Safety Board Investigated Accidents (1979-1989).

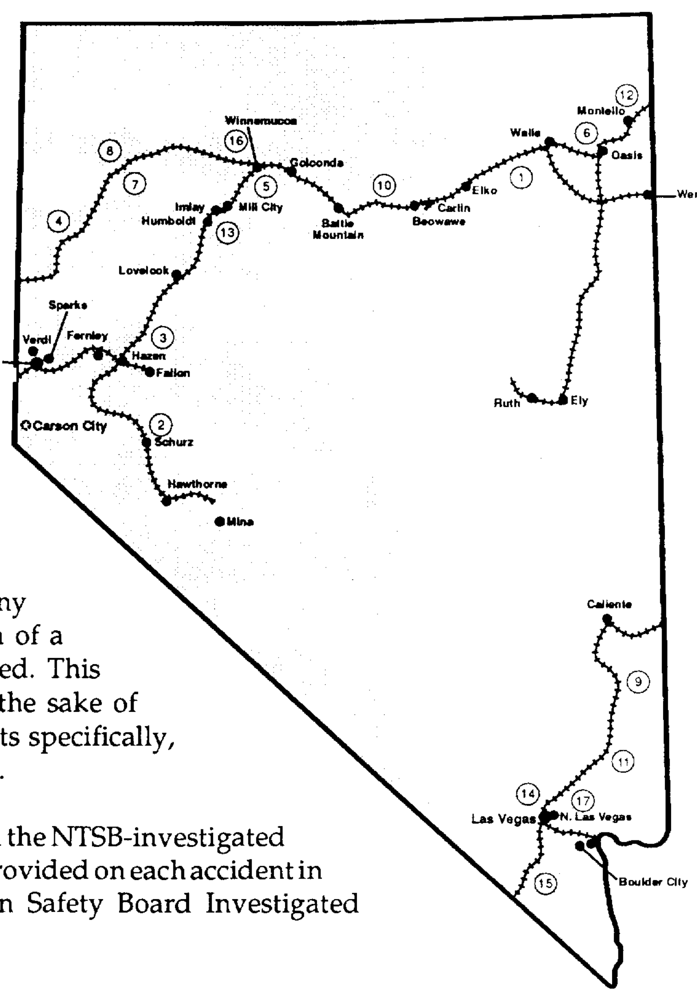

Figure 18 — Locations of Acccidents Investigated by the NTSB
Note: Numbers refer to accident numbers in Appendix D

Table 7
Accidents in Nevada Investigated by the NTSB

Accident No.	Date	Carrier	Type Accident	Location	Casualties Inj.	Casualties Fat.
1	2/21/79	SP	Derailment	Deeth	0	0
2	10/31/79	SP	Derailment	Schurz	0	0
3	11/5/79	SP	Derailment	Massie	0	0
4	1/28/80	WP	Derailment	Sano	0	0
5	4/12/80	SP	Derailment	Winnemucca	0	0
6	6/9/80	SP	Derailment	Barth	0	0
7	7/16/80	UP	Derailment	Islen	0	0
8	3/26/81	UP	Derailment & Collision	Islen	5	0
9	6/6/81	Amtrak	Derailment	Kyle	0	0
10	5/28/84	UP	Derailment	Dunphy	0	0
11	8/19/84	UP	Derailment	Farrier	0	0
12	6/22/85	SP	Collision	Montello	3	1
13	6/20/86	SP	Derailment	Mill City	1	0
14	5/23/88	UP	Haz Mat Spill	Las Vegas	0	0
15	9/22/88	UP	Derailment	Sloan	1	0
Accidents Currently Under Investigation						
16	6/12/89	SP	Rail/Hwy Coll.	Winnemucca	3	2
17	6/27/89	UP	Derailment	Las Vegas	0	0

Carrier Code: UP = Union Pacific WP = Western Pacific SP = Southern Pacific Amtrak = National Railroad Passenger Corporation

13 ESTIMATION OF RAILROAD MAINLINE ACCIDENT RATES IN NEVADA, 1984-1988

Railroad accident rates for over-the-road train operations in Nevada were estimated using information about the operation of trains on main and branchline tracks and associated passing tracks. Accidents that occurred in switchyards or during industrial switching, accidents that involved track maintenance equipment, and rail-highway grade crossing accidents that were not reported to FRA F 6180-54 were not included. The accident rate was determined for the period 1984-1988 based on accident records obtained from the FRA Accident/Incident Data Base, FRA F 6180-54.

The rail accident rate is herein defined as the number of accidents occurring per train-mile of travel. A train is defined as any consist that can operate under its own power and includes a locomotive (to eliminate highway vehicles used for on-track maintenance). Knowing the number of accidents, the principal challenge in deriving rates is to estimate train-miles of travel for the period of interest. These data are undoubtedly known to the railroad companies. Time and budget limitations, however, required the use of an estimation procedure for this study.

Train-miles is only one unit of exposure that could be used to generate accident rates. Other units include car-miles and ton-miles. Although these may be appropriate units for certain classes of accidents, they are more difficult measures to obtain or estimate than train-miles. In addition, they are less useful for a general examination of all accident types.

The general procedure used to estimate accident exposure was as follows:

— Define the Nevada rail network

— Obtain route mileage for all network segments

— Estimate train volumes/week on each segment

— Calculate train-miles/year (train volumes/week * route-miles/segment * 52 weeks/year) for each segment

— Sum the estimated train-miles for all segments and train types

These steps are described in more detail below.

The Nevada rail network was defined using railroad industry maps, the Rand McNally Railroad Atlas, the SNDT (1987), and railroad employee timetables for the lines in Nevada. These sources also provided mileage information for the line segments.

Weekly train volumes were estimated using data from various railroad trade journals, the Nevada Rail Plan, and Amtrak schedules. The figures in these sources do not always agree; therefore, the figures used must be considered approximate. Daily train volumes from the data were converted to weekly volumes to account for the fact that some trains do not operate on a seven-day-per-week schedule. The estimate used in this report represents operations during 1985 and 1986. This is about the midpoint of the 1984-1988 analysis period.

One possible inconsistency with the train volume estimate is that, except for Amtrak service, volumes fluctuate with time. A second possible inconsistency is the estimation of work trains and other special train volumes. Finally, train-miles for yard and industrial switching movements could not be estimated because these operations fluctuate greatly. All these conditions, therefore, were neglected in this analysis. The resulting volumes are for road operations only.

To obtain annual train-miles of travel, the weekly segment volumes were converted to annual volumes and multiplied by the segment mileage. The resulting train-miles of travel for each segment were then summed to generate the total train-miles for the state. The numbers obtained were:

Train Type	Train Miles
Passenger Trains	493,038
Other Trains	4,473,971
Total	4,967,009

Accident data were collected for 1984-1988 from the FRA Accident/Incident data set. Accidents occurring on mainlines and sidings were selected for this analysis because they best represent road operations. A total of 36 accidents were found. These accidents involved 42 separate trains, three of which were passenger trains. The resulting rates were:

	Avg. Annual Over-the-Road Accidents/ Involvements	Annual Train-Miles	Rate/Million Train-Miles
Passenger Trains	0.6	493,038	1.22
Other Trains	7.8	4,473,971	1.74
All Trains	8.4	4,967,009	1.69

For comparison, all accidents were analyzed to determine an overall accident rate that includes switchyard and industry spur accidents. A total of 50 accidents was found: three passenger trains and 47 other trains. The calculated rates were as follows:

	Avg. Annual Total Accidents/ Involvements	Annual Train-Miles	Rate/Million Train-Miles
Passenger Trains	0.6	493,038	1.22
Other Trains	9.4	4,473,971	2.10
Accident Frequency	10.0	4,967,009	2.01

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APPENDIX A
RAILROAD TECHNOLOGY

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RAILROAD TECHNOLOGY

Track Grade

The grade of a track is the rise or drop in elevation between two points along the track centerline. Traditionally, grade has been measured as the elevation change in feet per hundred feet of linear distance, or percent. A positive grade is climbing, and a negative grade is descending. Grades are an important factor in train operations because the amount of force required to start a train and keep it in motion is influenced by the grade. Every percent of ascending grade adds 20 pounds per ton of train weight to this force. Maintaining train speeds in ascending grade territory requires applying additional power or extra locomotive units. If this is not done, the train slows down or stalls. Descending grades require braking to keep the train at safe speeds and to prevent loss of control.

Abrupt changes in grade can create high stresses within a moving train, especially when curves are also present. These stresses can force cars from the track, overturn rails, and break couplers and drawbars if the train is not handled properly. The braking, speed reduction, and extra power requirements of positive grades are major cost and safety elements in train operations. It is, therefore, highly desirable to keep grades at a minimum. A mainline grade of 1 percent or less is considered desirable, grades of 1-2 percent are moderate, and grades of 2-3 percent are severe for mainline operation. Branchline standards are somewhat more relaxed, but grades of 4 percent or more are rare in the United States. Length of grade is also an important consideration. Short grades often require little throttle or braking action for a moving train because the train is not on the grade long enough for it to have any real effect. A short stretch of steep grade may therefore have less effect than a long stretch of a lesser grade.

Track Structure

The track structure consists of subgrade, ballast, ties, and rail. The subgrade is the underlying earth foundation for the track. Desirable properties of subgrade are free drainage, mechanical strength, and the absence of fine particles, such as silts and clays. Ballast is the supporting structure for the rails and ties. The ballast maintains the ties and rails in a consistent horizontal and vertical alignment, distributes the train forces from these components into the subgrade, and provides drainage. Ballast is generally a crushed stone, preferably granite or a similar mineral having high strength and resistance to wear. Typical mainline ballast particles are 2-3 inches in diameter. On less traveled lines, ballast may consist of smaller particles and different materials, such as cinders, sand, limestone, etc. Ties support the rails, maintain their spacing, and distribute train forces into the ballast. Traditionally, most ties in the United States have been wooden. Steel plates on wooden ties support the rails and prevent damage to the tie. Spikes keep the rails from moving laterally on the tie. Research has been underway to develop a substitute for the wooden tie. Prestressed concrete ties have recently entered wide use in the United States. Although more expensive than the wooden tie, the concrete tie results in smoother track and is longer lived (50 years vs. 20 years). Rails guide the train and support its weight. The typical steel rail has a "T" section and ranges in weight from 90 to 150 pounds per yard. Modern mainline rails are typically in the 130-139 pounds per yard range. Rail is manufactured in 39-foot lengths. These rails may be laid down on the ties and mechanically connected using bolts and joint bars. This is called jointed rail. Increasingly, railroads are eliminating the troublesome joints, which require maintenance and costly hardware and affect ride quality, in favor of continuously welded rail (CWR). CWR is constructed by shop welding the rail sections into strings of one-quarter mile or more. These are carried to the track site and installed. The strings are then connected using field welds to eliminate the remaining joints.

Control Systems

Trains are a single degree of freedom transportation mode—meaning they can move only back and forth along the fixed guideway. A control system is necessary to keep the vehicles in proper relation to each other and to prevent collisions.

Yard Limits, the simplest method of train control, requires the train crew to look out for conflicting movements. Because of the inherent risk involved, train speeds must be kept low. With these low speeds, the line capacity is also kept low. Terminals and yards often use this type of control under so-called yard limits. Trains in yard limits must move at a restricted speed (usually 20 mph) which allows them to stop within one-half the range of vision.

Direct Traffic Control (DTC) is a method of train control in which the line is divided into a series of fixed blocks. Trains are assigned the right to operate within a block in a specific direction by the dispatcher. Opposing movements within a block are generally forbidden. Trailing movements may be allowed under some circumstances. Generally, however, a train has exclusive right to a block until it exits and returns control to the dispatcher.

Track Warrant Control (TWC) is similar to DTC except that the block boundaries are variable. The dispatcher authorizes a train to move between two arbitrary points on the line. This increases the flexibility of operations and can increase capacity. As soon as a train passes a known point, the dispatcher can move the block limit of a following train to that point by issuing a new warrant. Trains may not move past the limits of their warrant without dispatcher authorization.

Automatic Block Signal (ABS) is a system in which the track is subdivided into fixed blocks, with the entrance to each block protected by a signal. Track circuits detect the presence of a train in a block and control the signal aspects. The signals indicate to the train the maximum allowable speed within a block and, in some cases, within the next few blocks ahead. ABS functions primarily to increase track capacity and to improve safety rather than as a true control system.

Centralized Traffic Control (CTC) is a system under which trains move under the authority of signal indications set by the dispatcher from a central location. From a control console, the dispatcher controls all sidings and junctions and monitors train movements. The equipment prevents the issue of conflicting directions that might cause a collision. Trains receive signals at the control points that authorize their further movements. Unlike ABS, CTC signals are absolute and trains may not pass them until authorized. ABS is often used between the control points. Modern CTC systems are often partially or completely computerized; manual intervention is necessary only for exceptional conditions.

Communications

Communications between the train crews and the controlling personnel are vital. Accordingly, railroads have one of the most extensive private communications networks in the country. On most railroads, train crews and maintenance personnel communicate with the dispatcher via high-frequency radios. The railroads have radio repeaters and base stations alongside the line for the dispatcher to use. These repeaters are often connected to the dispatching center many miles away by microwave transmitters. In addition, crews use railroad telephones located at strategic locations, such as junctions and passing sidings, to communicate with the dispatcher when the train is stopped. These may be connected via land-line or microwave with the dispatching center.

Where there are signals in place on a line, the railroad has control and power distribution lines in place. The signals receive normal operating power from trackside lines, although battery backups are mandatory. Copper control lines for the CTC system have been traditionally used, but new installations increasingly feature microwave for all or part of the control signal transmission.

Automated Safety Devices

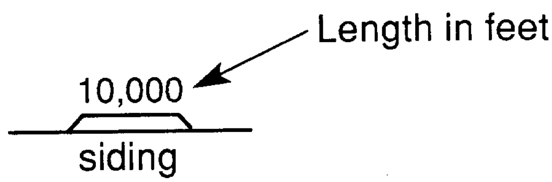
Railroads have an ongoing campaign to install automated safety devices along the track to detect unsafe conditions and to warn the train crew before a mishap occurs. These devices may warn the crew by signal indication, by direct radio transmission using voice synthesis, or by providing an indication to the dispatcher or station employee to contact the train. Wheel bearing failures, or hotboxes, have traditionally been a major cause of derailments. When a bearing fails, the resulting friction melts the axle end causing the wheelset to drop away. Devices to detect this excess heat have been perfected. By placing these at regular intervals, overheated axles can be detected, and the train can be stopped before the failure occurs. Dragging equipment indicates actual or potential derailment. A derailed car may be pulled along for miles and may damage thousands of ties before it reaches an object that causes a massive pileup. With the removal of cabooses from most trains, there is no longer a crew member on the rear of a train to detect a derailed car. Devices have been developed that detect dragging equipment. These rely on the movement of a hinged plate or the breaking of a brittle wire between the rails.

Clearance detectors placed near locations of restricted clearance (e.g., the mouths of tunnels or at bridges) detect shifted loads or excessive dimension that might strike these objects. Slide detectors, high water detectors, and high-wind detectors are other devices commonly employed to warn train crews of unsafe conditions.

APPENDIX B
NEVADA RAILROAD SYSTEM PROFILES

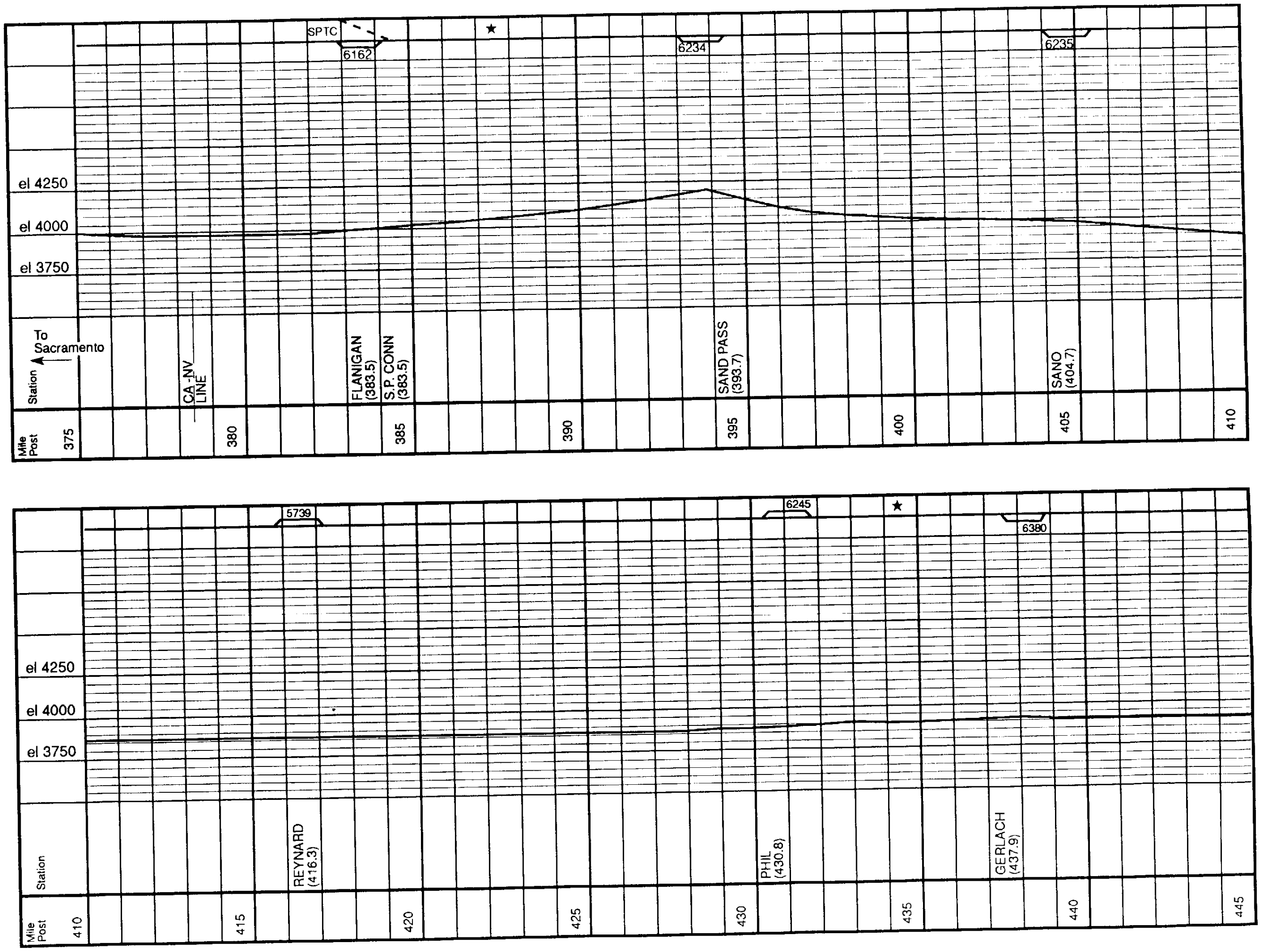
Nevada Railroad System Profiles

KEY

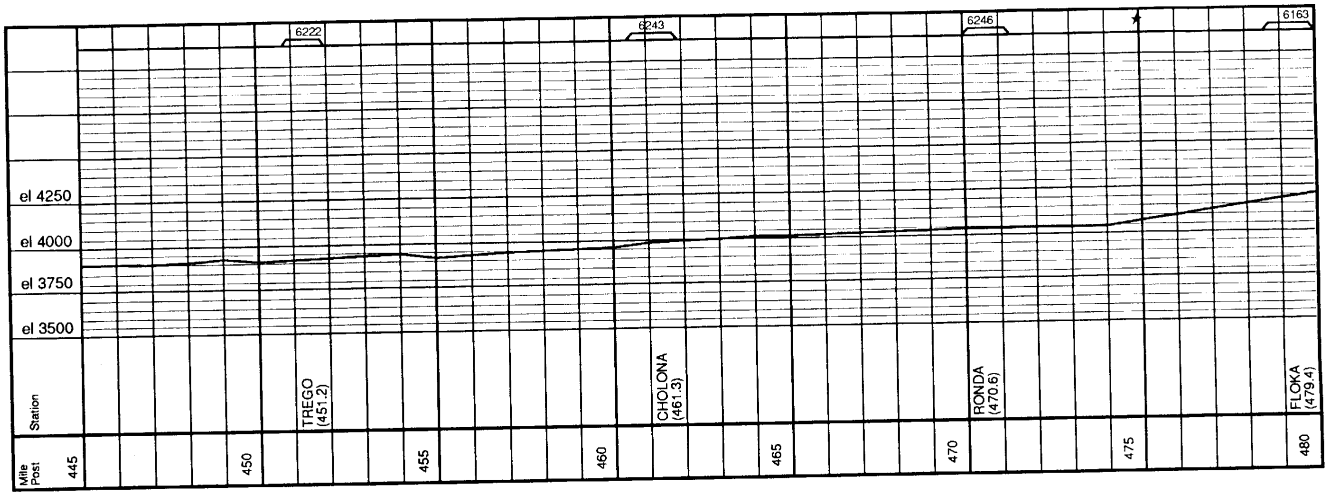


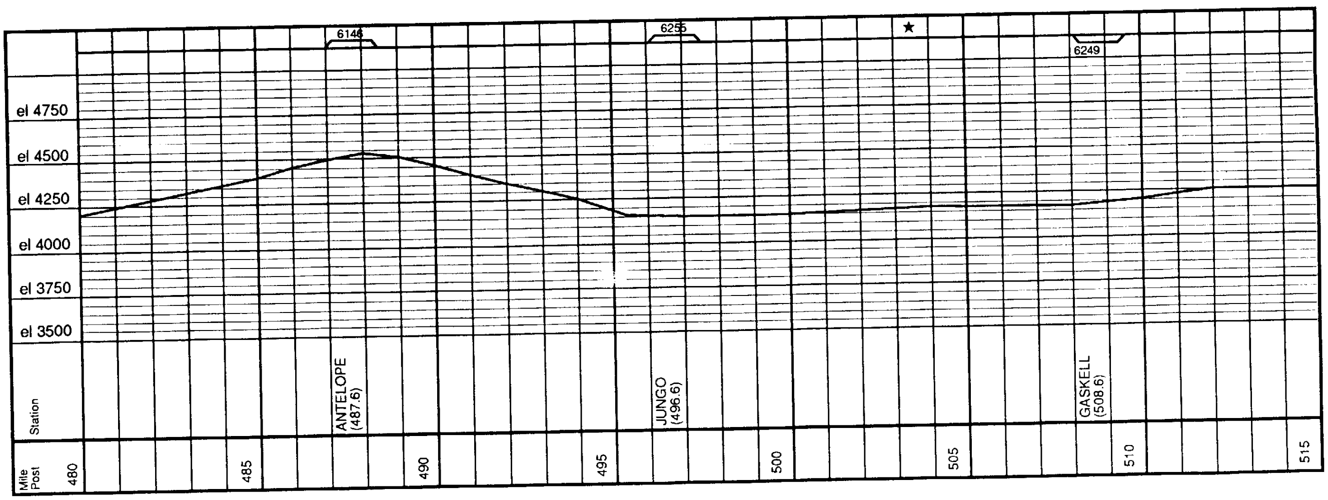
Detector Symbols

- ★ **Hot journal**
- ● **Dragging equipment**
- ▥ **Slide fence**
- ◺ **Overpass collision detector**
- □ **Highway detector**



UNION PACIFIC RAILROAD - FEATHER RIVER LINE





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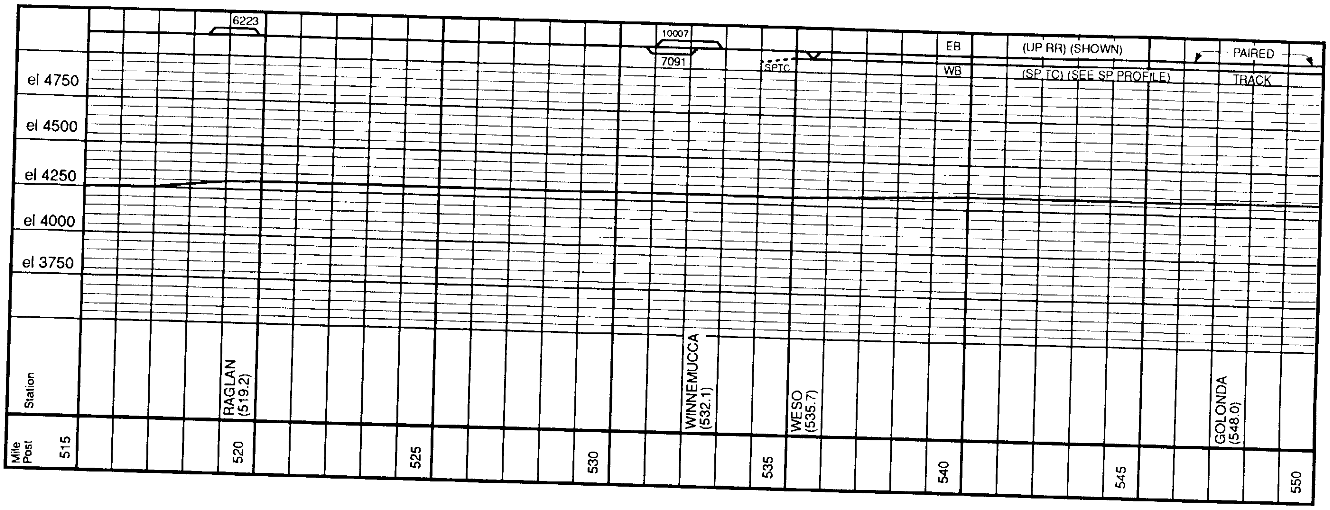

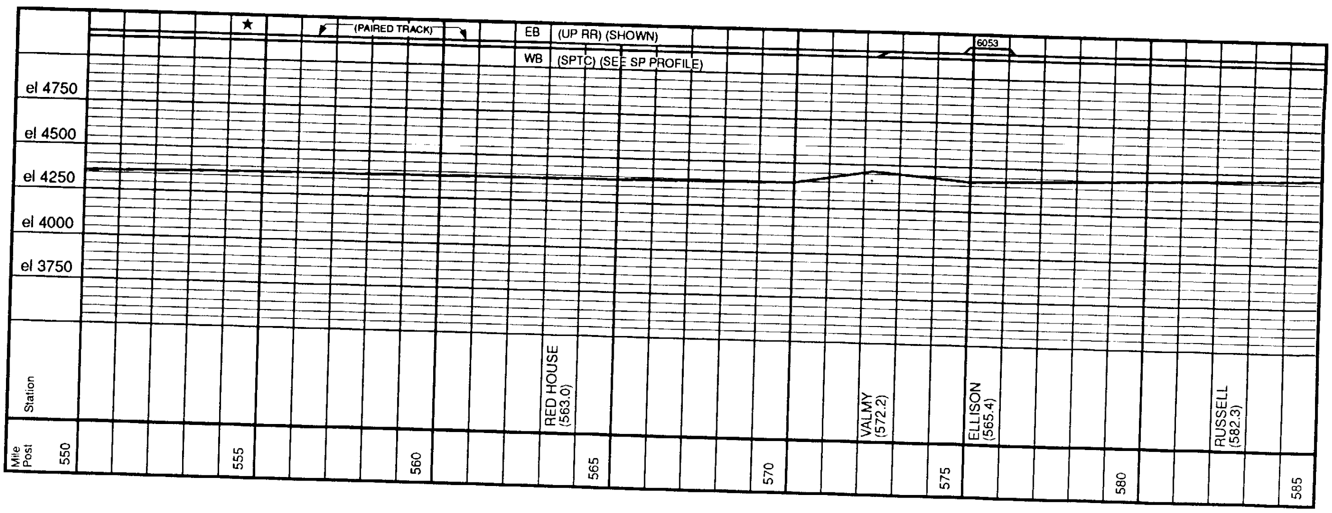

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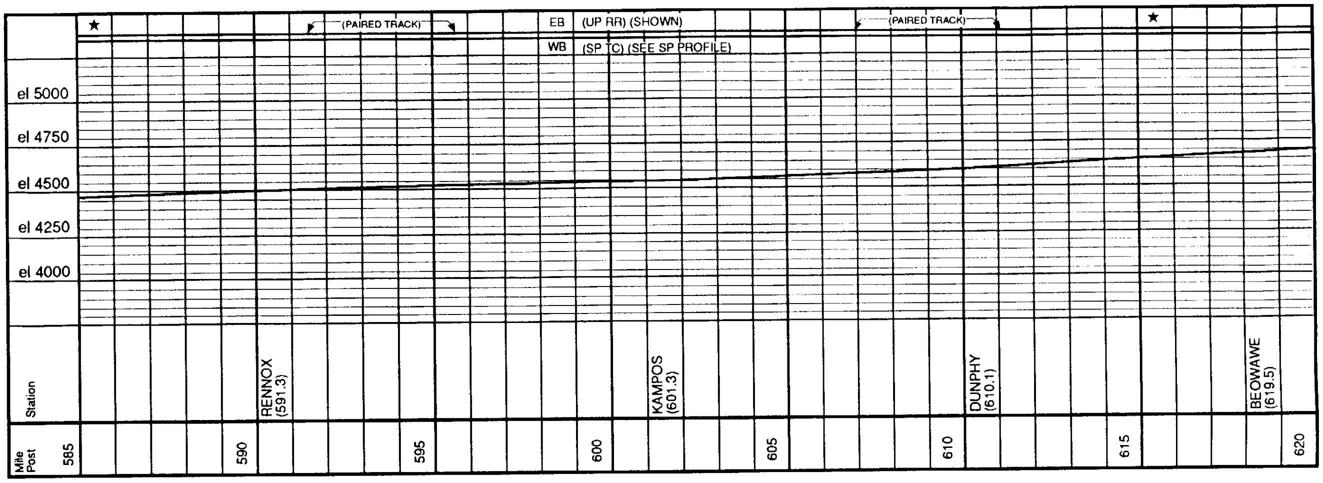

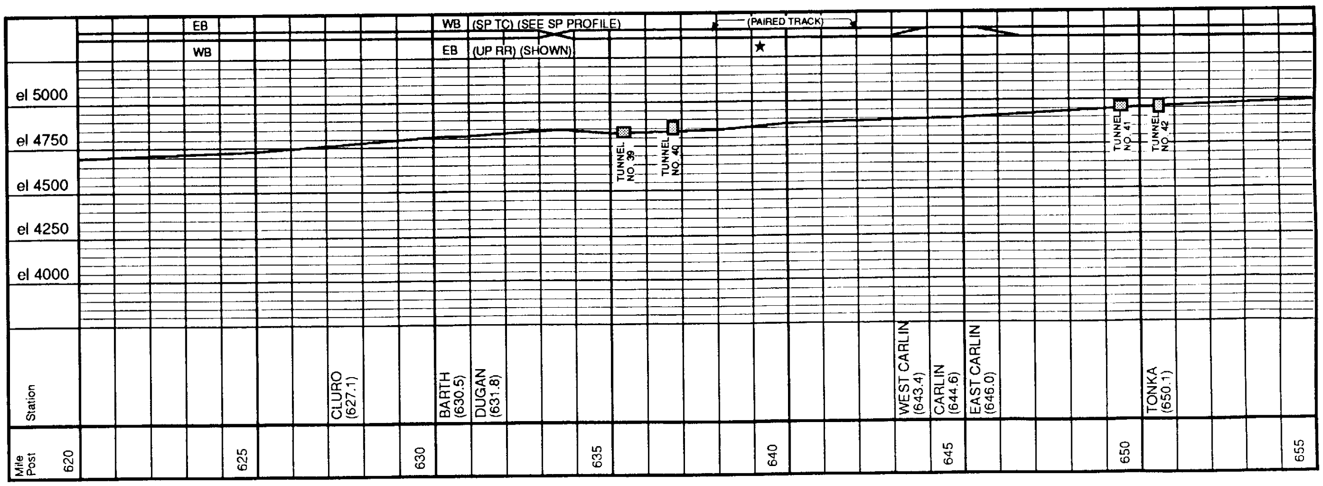

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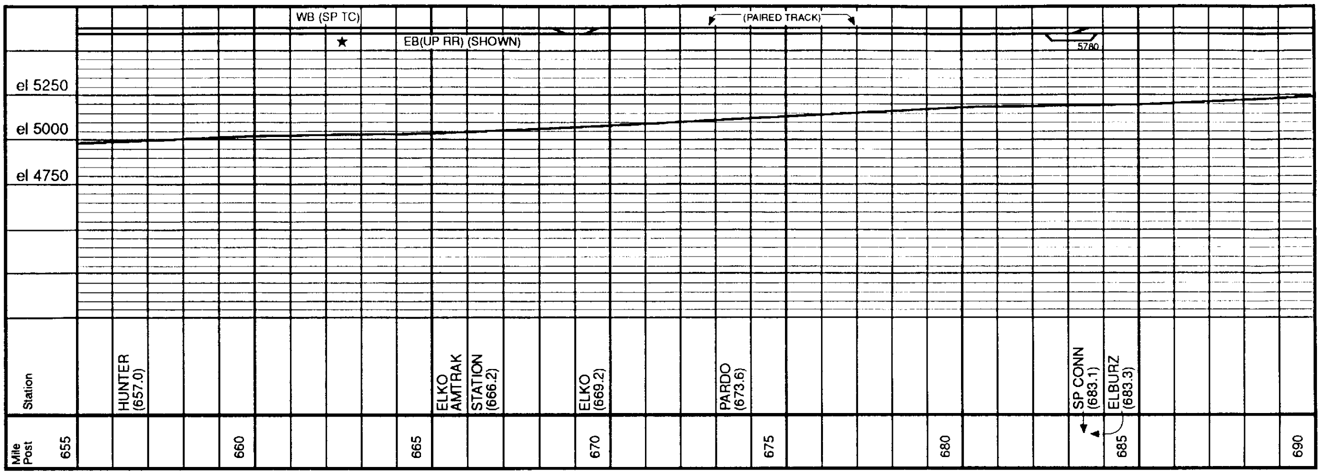

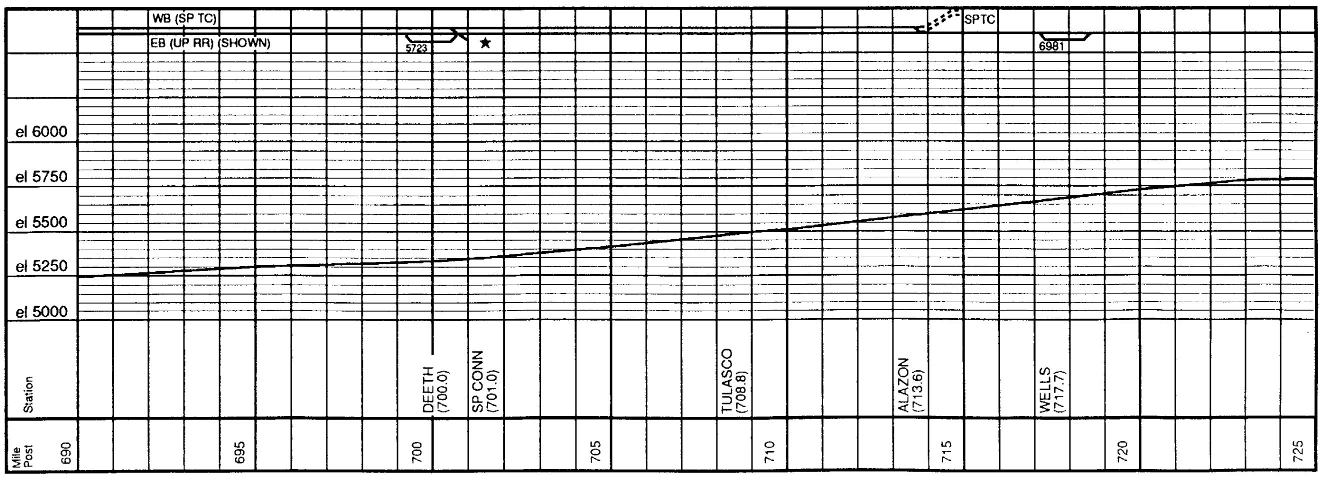

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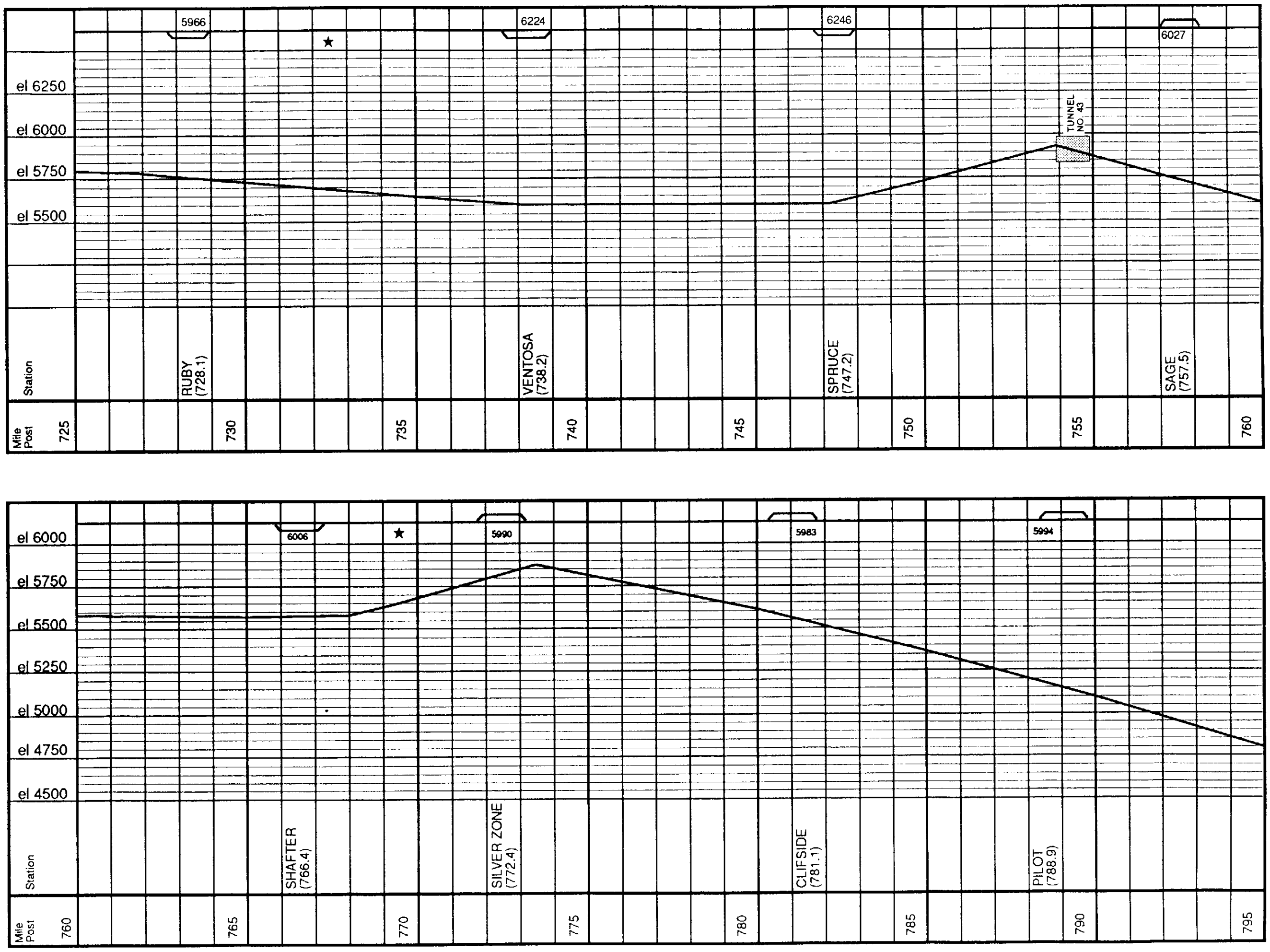

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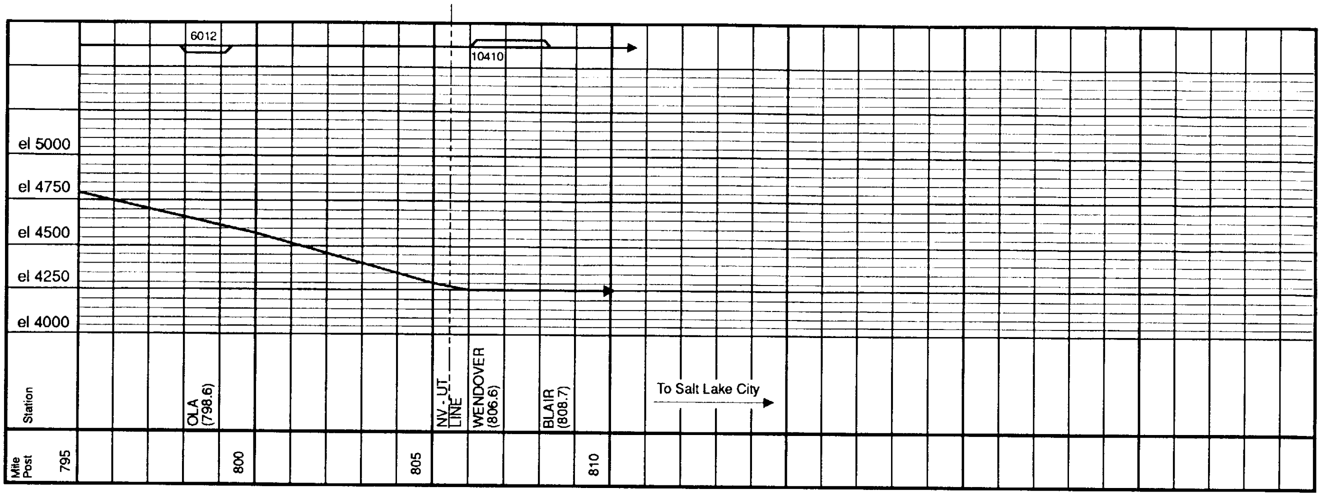

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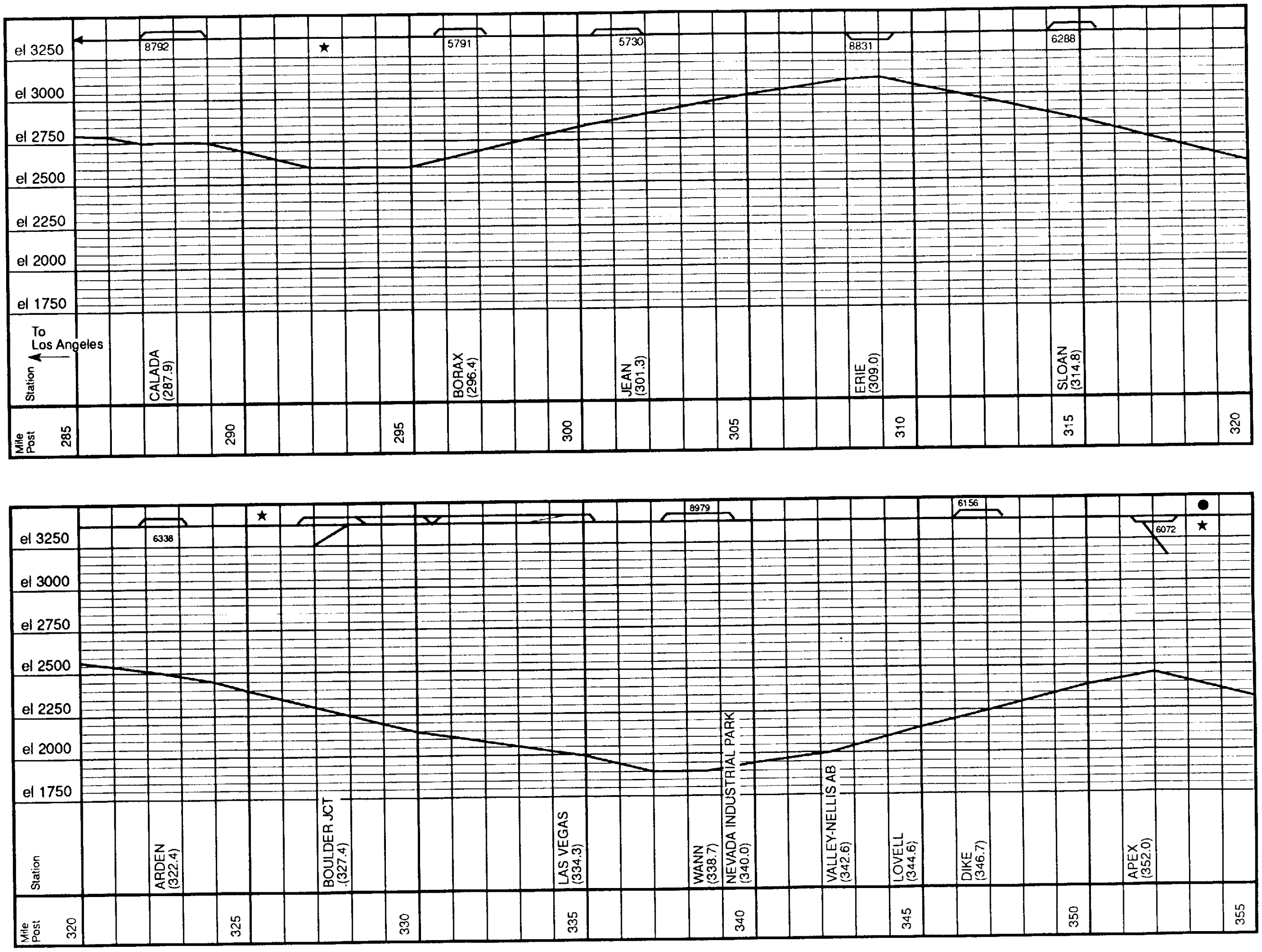
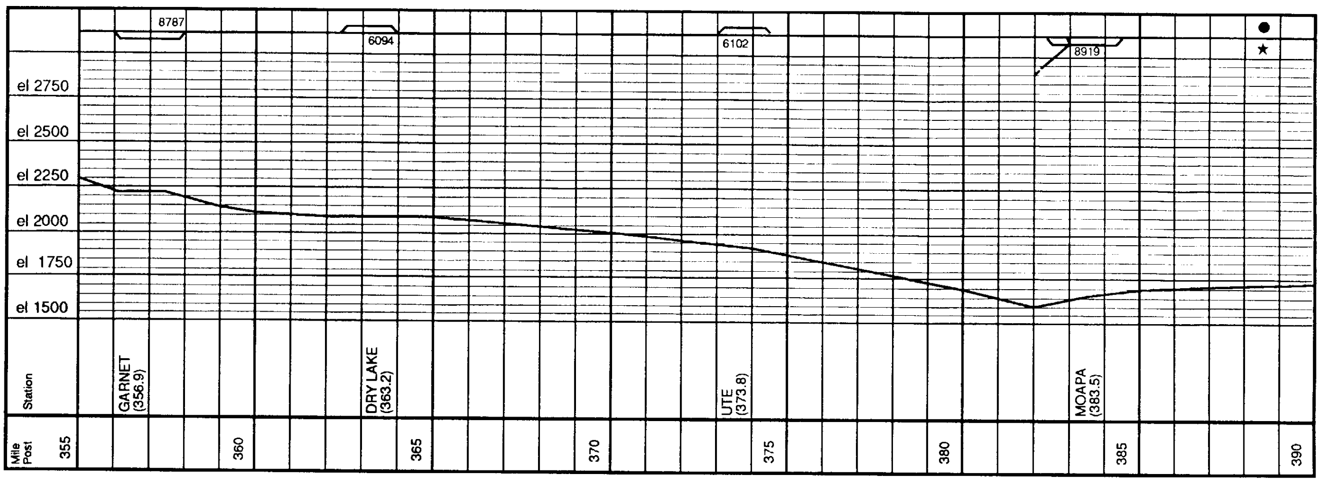
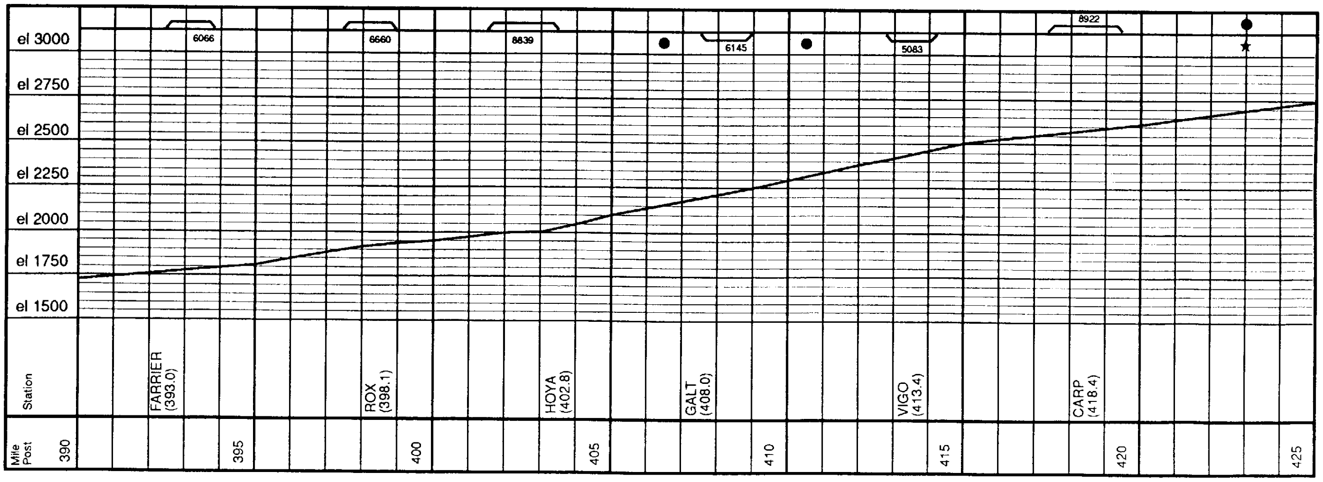


UNION PACIFIC RAILROAD - L.A. & S.L. MAINLINE





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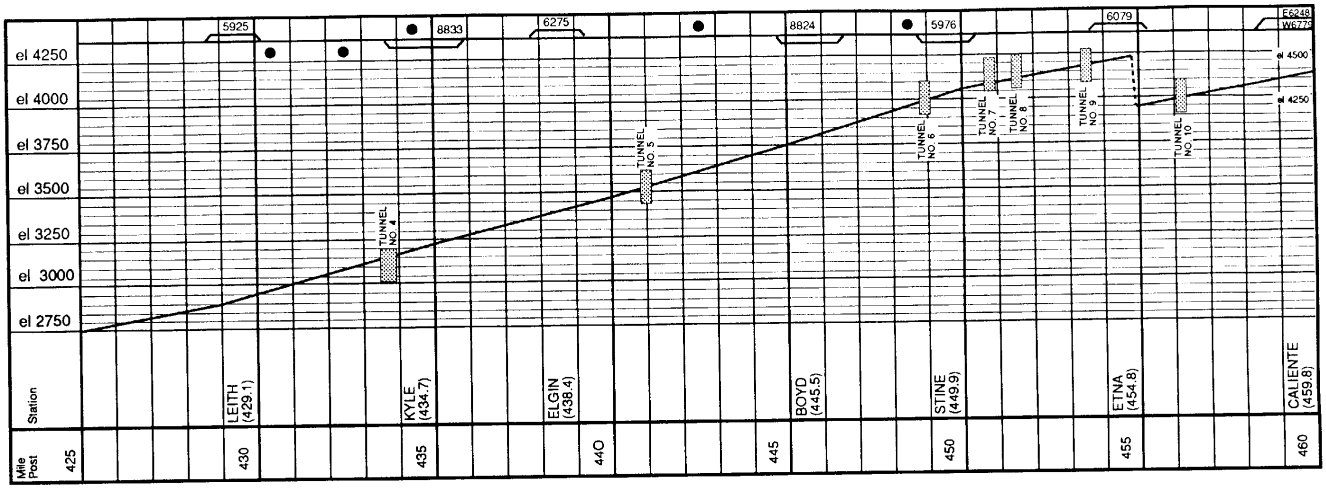

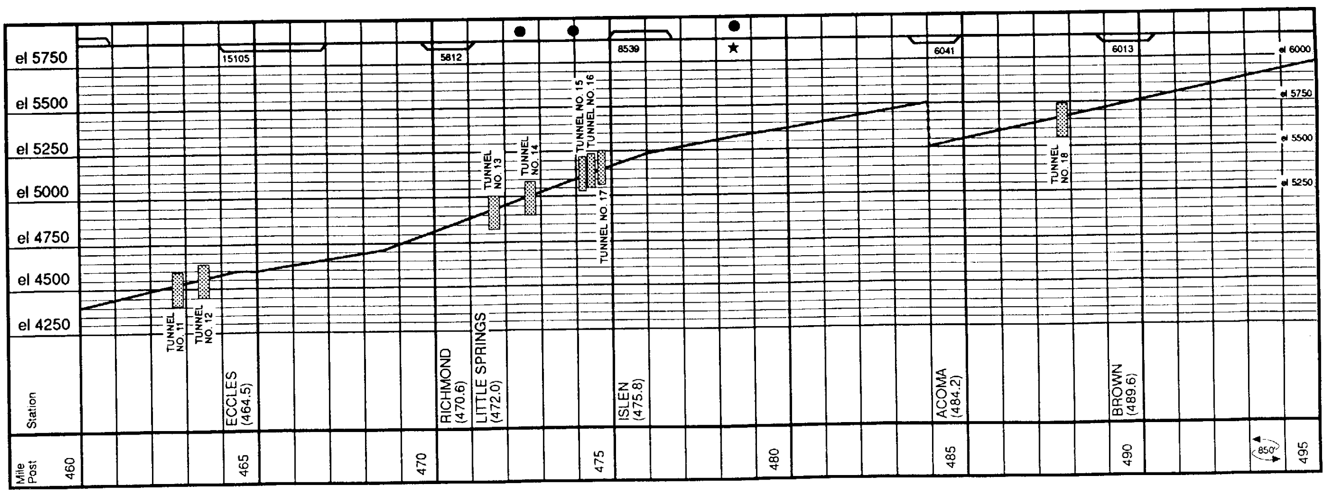

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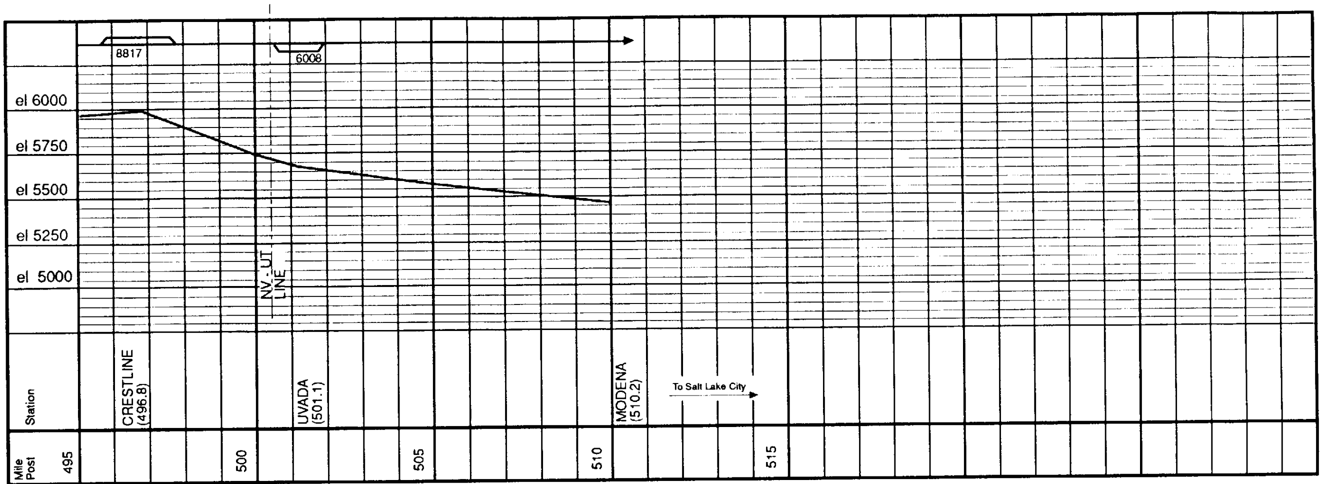

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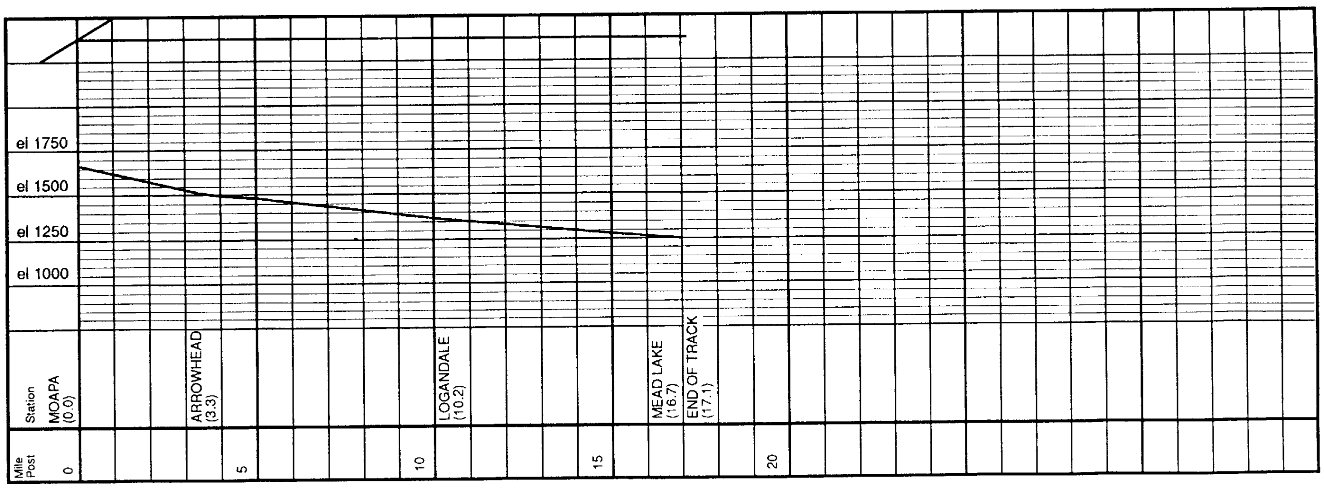

UNION PACIFIC RAILROAD - MEAD LAKE BRANCH

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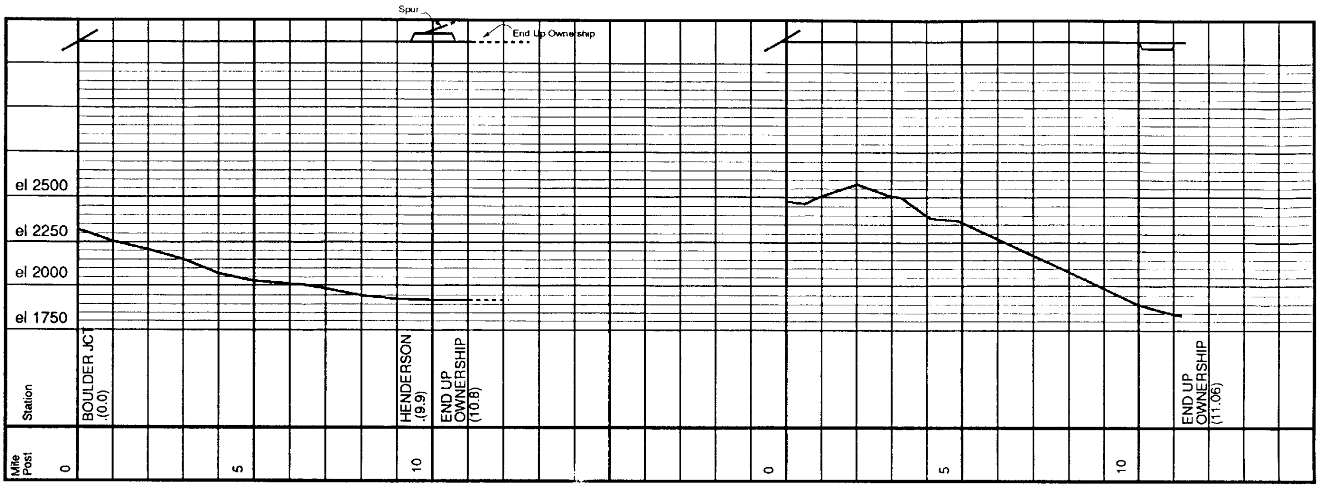
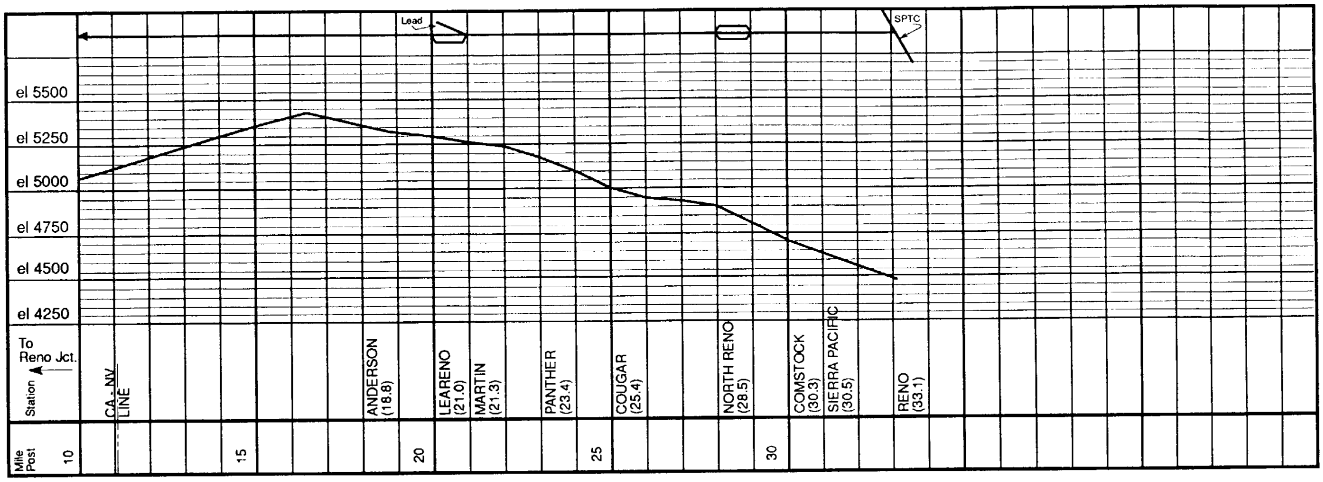


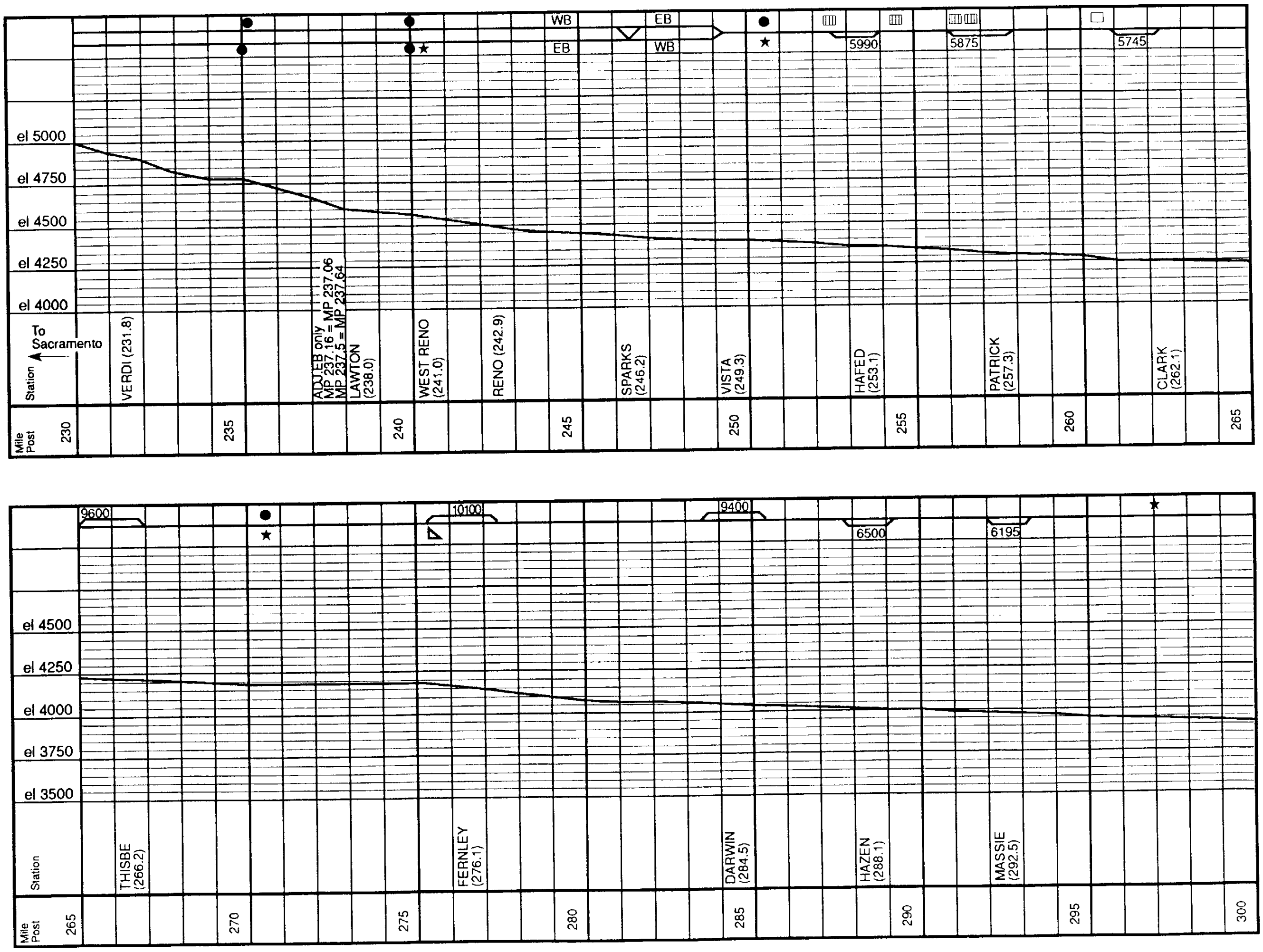
UNION PACIFIC - BMI BRANCH & FIBREBOARD SPUR

Other Accidents

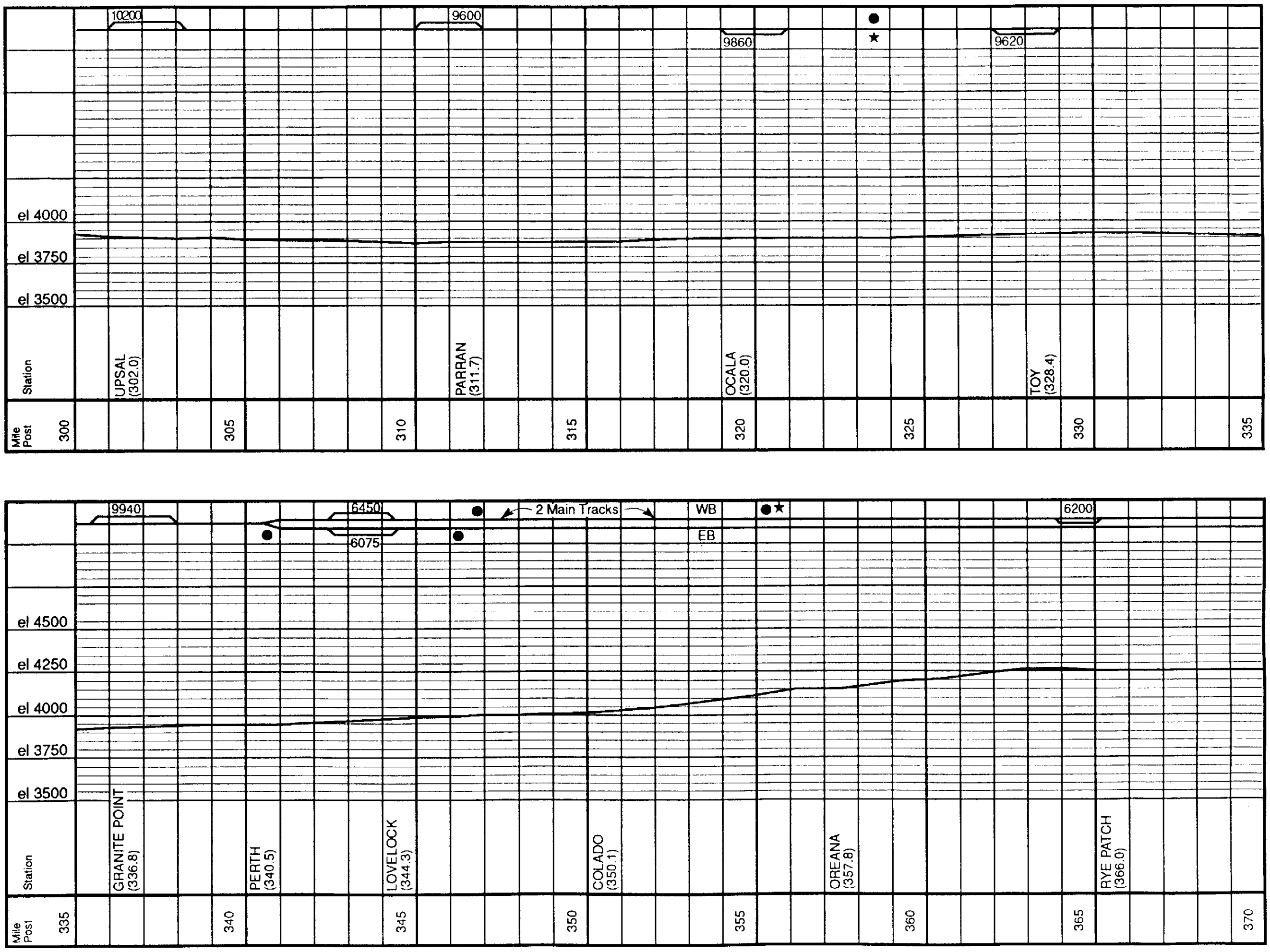
Two other accidents, one in Winnemucca on June 12, 1989 (Accident Number 16 in Figure 18), and one in Las Vegas on June 27, 1989 (Accident Number 17), are currently under investigation. The reports on these two most recent accidents are still in a preliminary stage. The accident near Winnemucca was a rail-highway grade crossing collision with an empty trailer. Three crew members were injured, one seriously, and two transients on the train were killed. The truck driver was not hurt. The accident in Las Vegas was a 21-car derailment in the Las Vegas yard. Some of the derailed cars came to rest over two pipelines, one carrying gasoline, the other carrying JP-4 jet fuel. There were no fires or release of hazardous materials, and no lines were ruptured or broken. As reported in the first paragraph of this section, two accidents (one at Wells, Nevada [Number 18], on September 12, 1981, and one at Winnemucca, Nevada [Number 19], on January 30, 1983) were investigated by the NTSB, but no reports were available through the public-inquiry section.



UNION PACIFIC - RENO BRANCH



SOUTHERN PACIFIC — OVERLAND ROUTE



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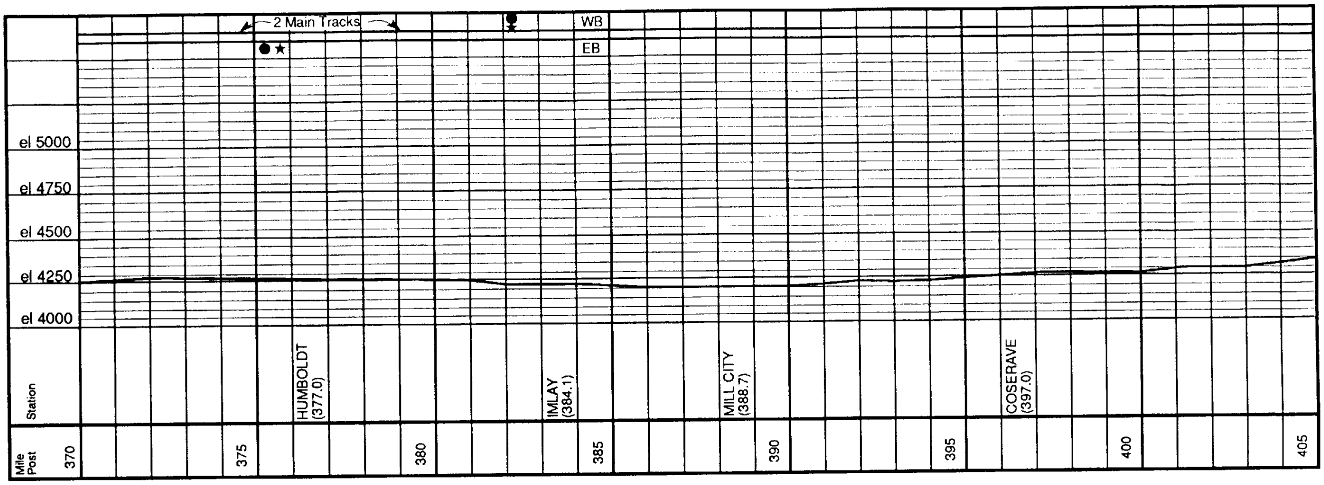

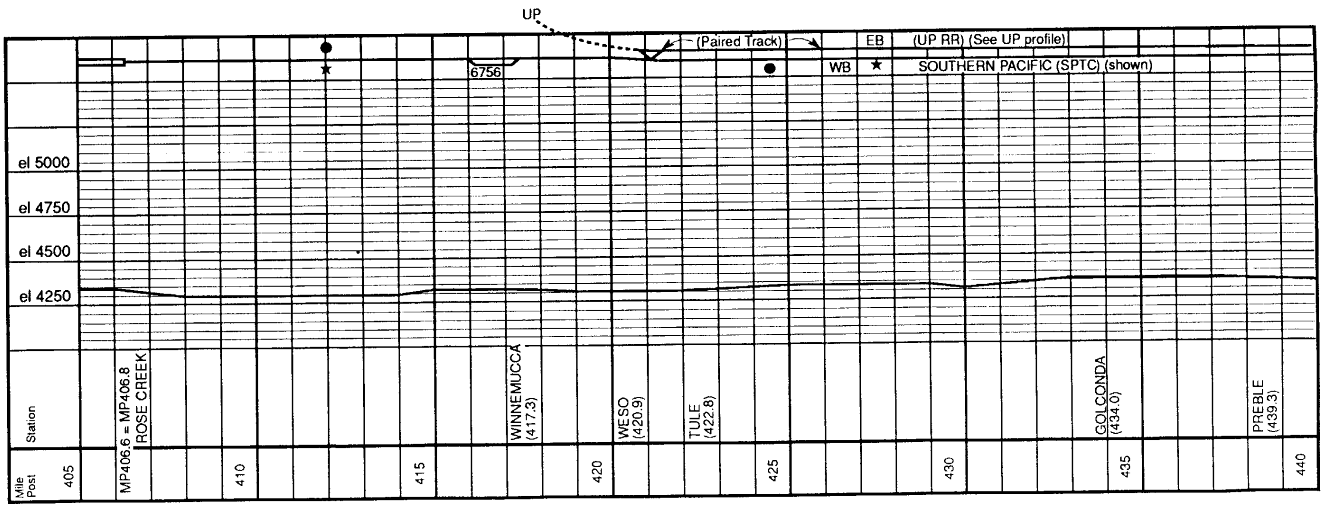

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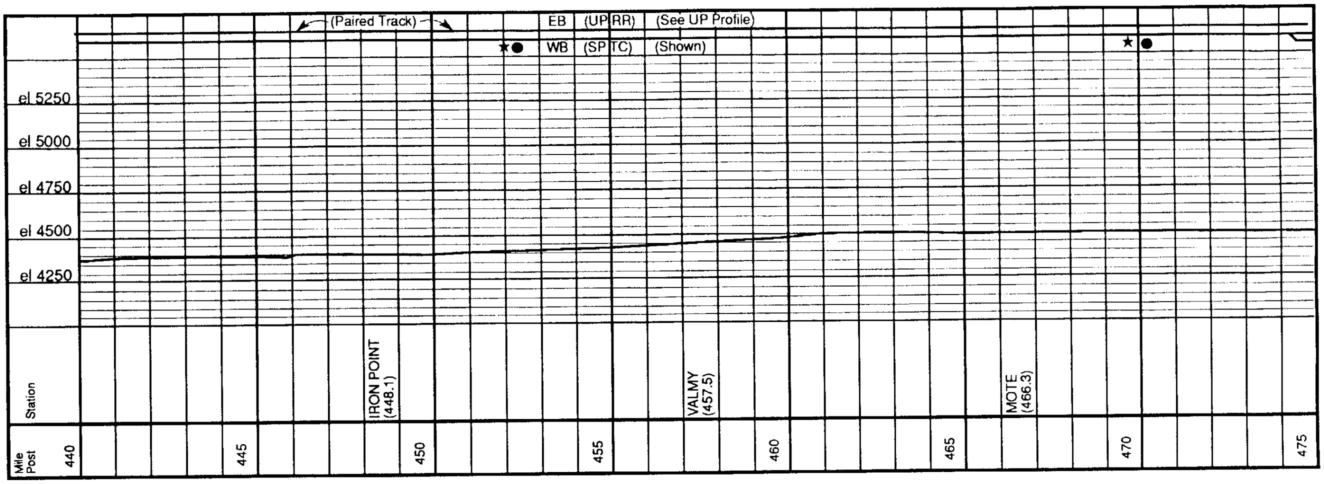

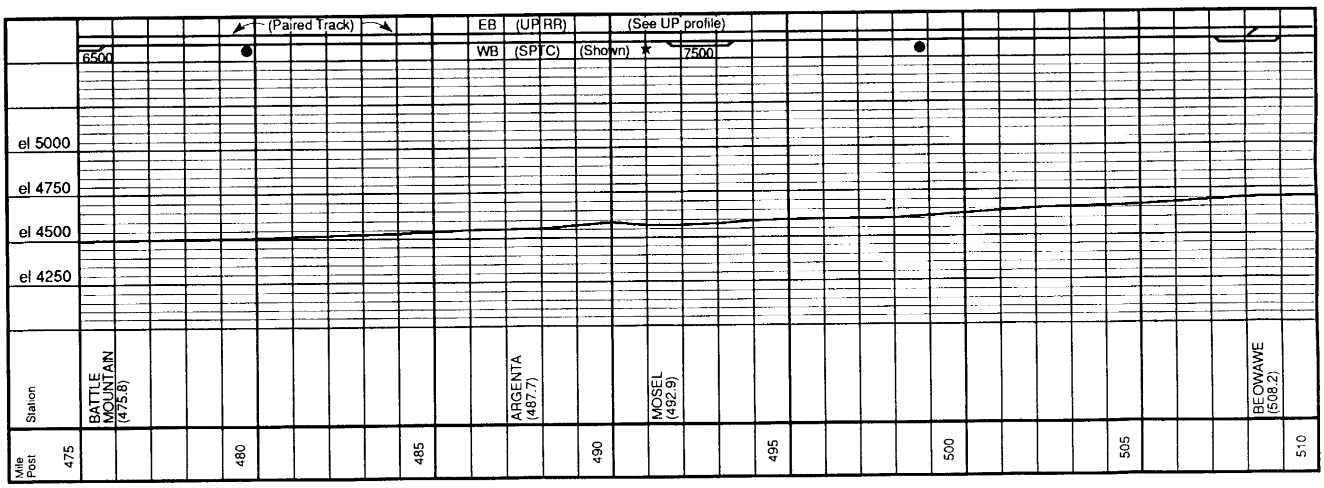

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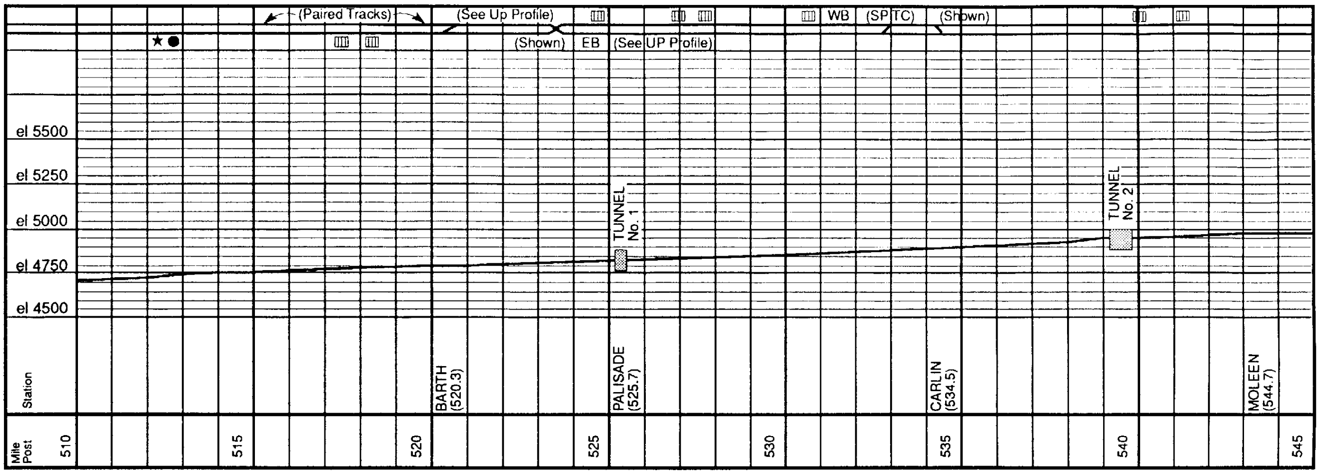

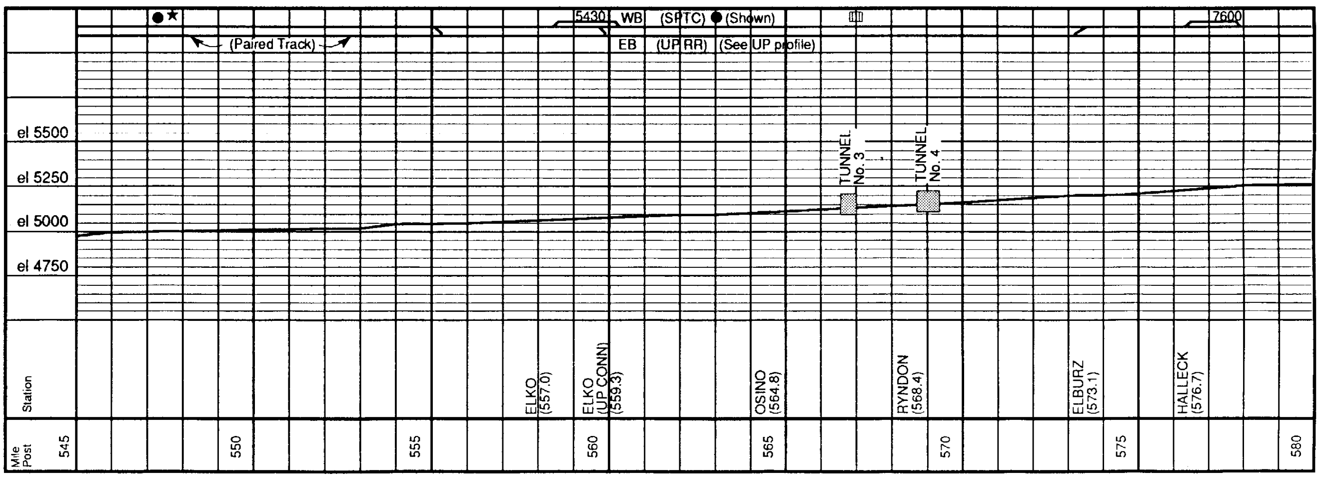

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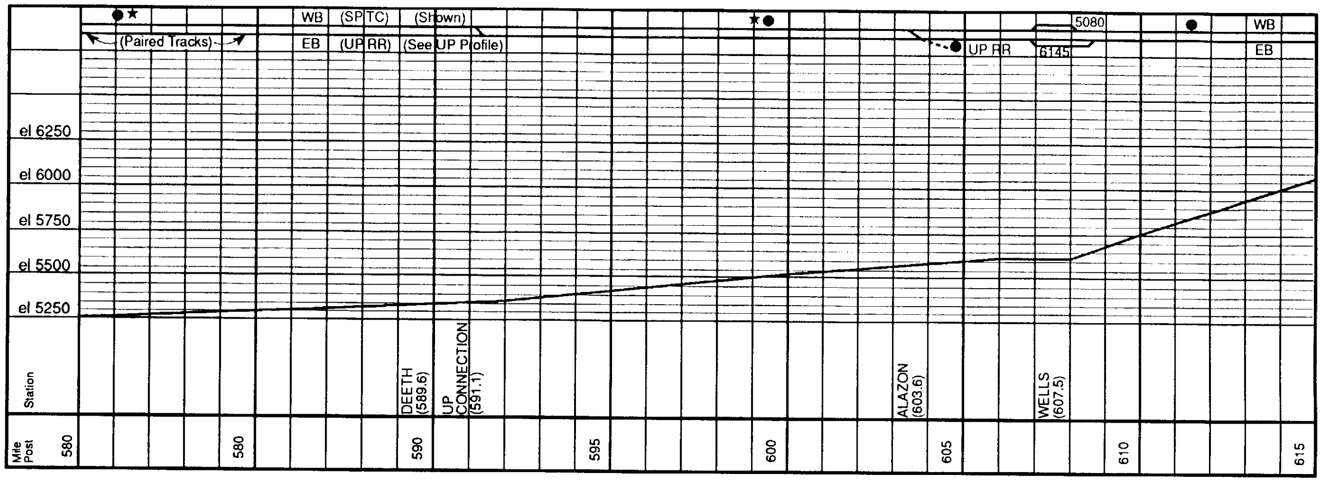

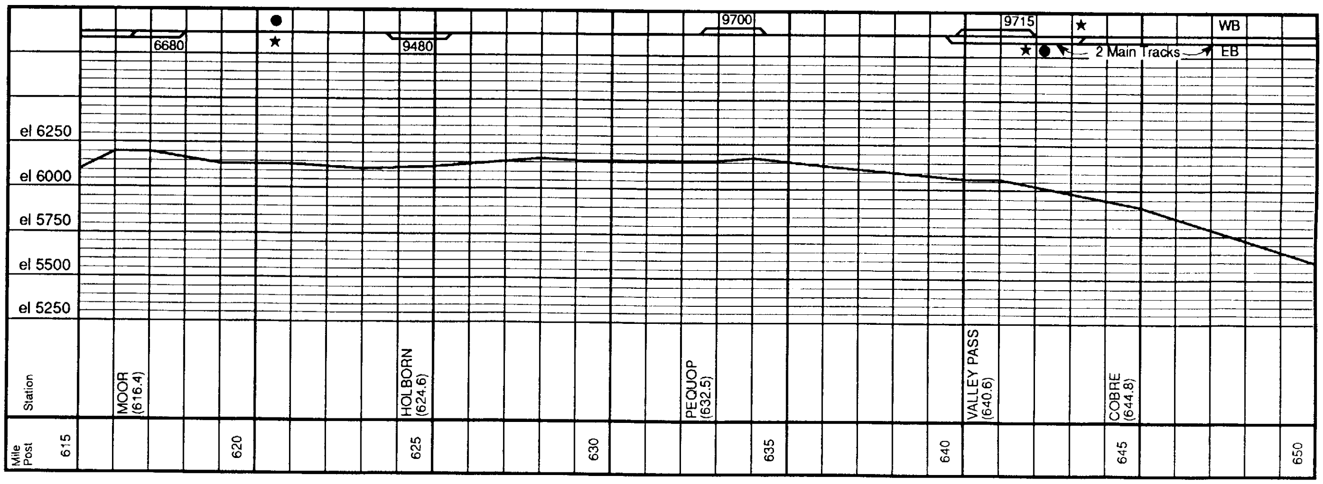

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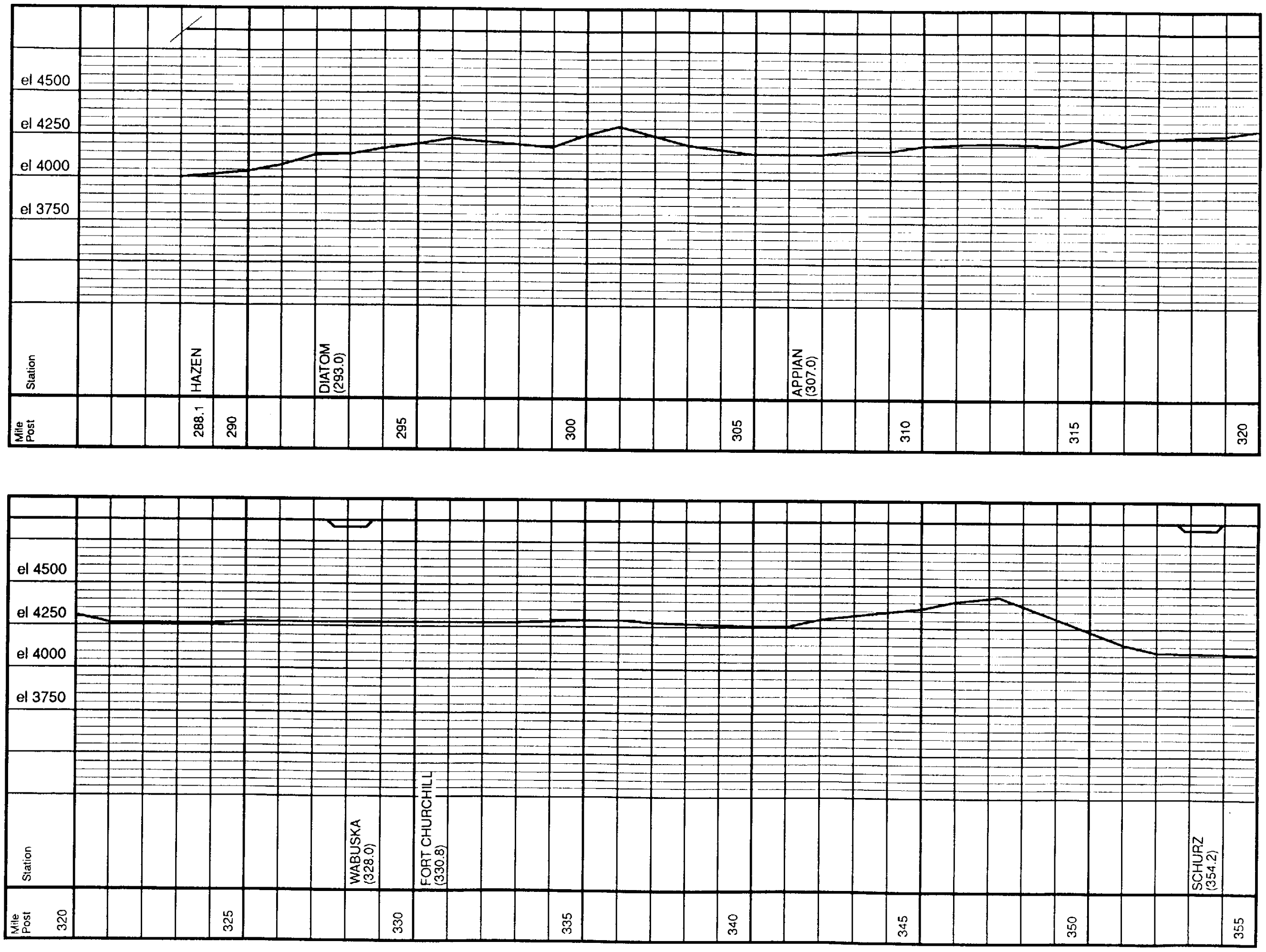
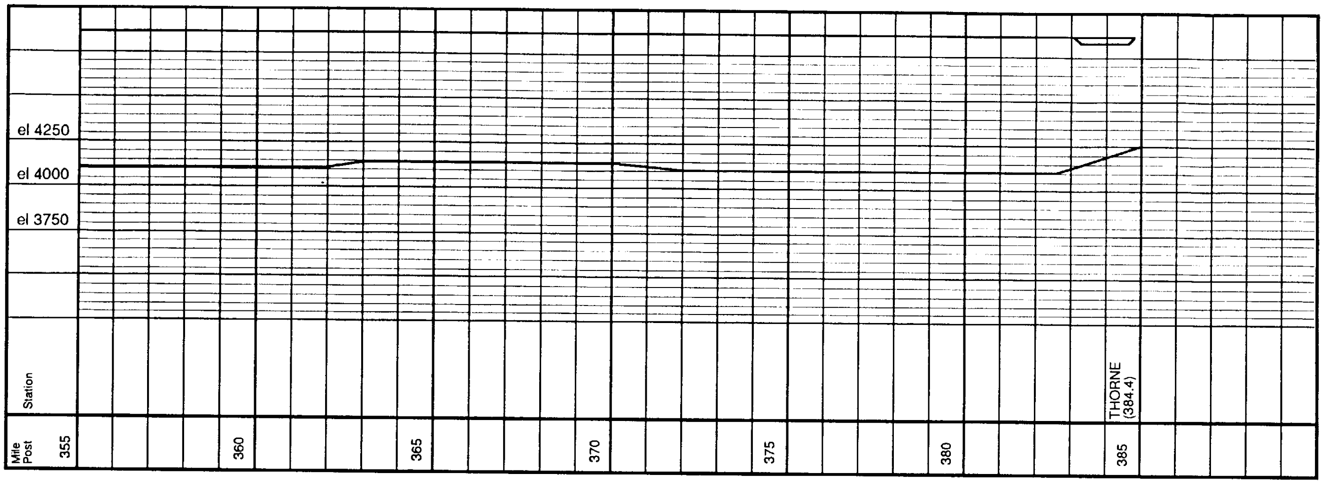


SOUTHERN PACIFIC - HAZEN-THORNE BRANCH



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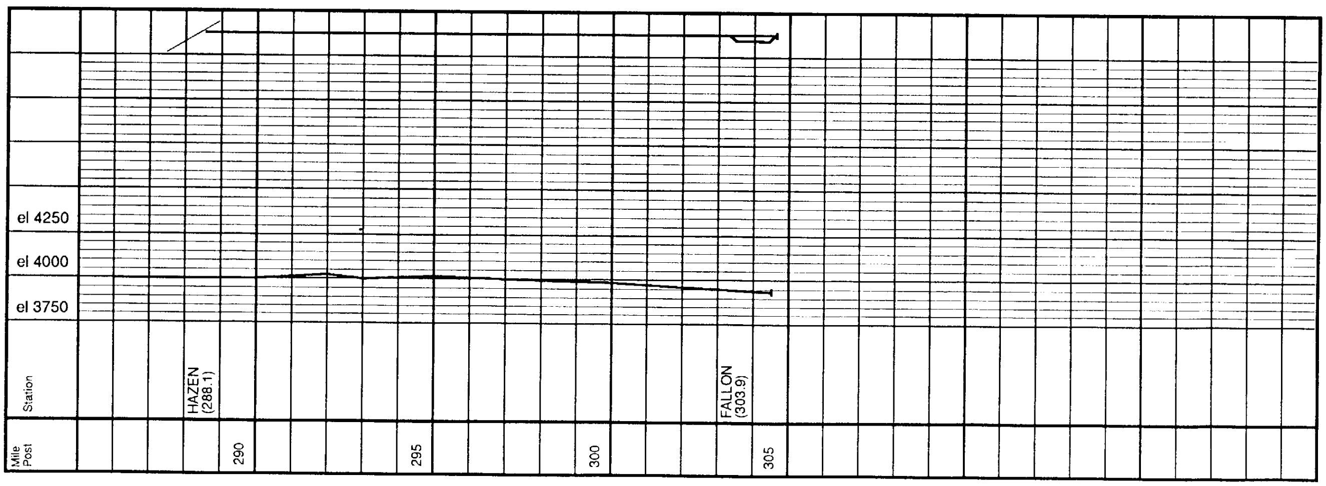

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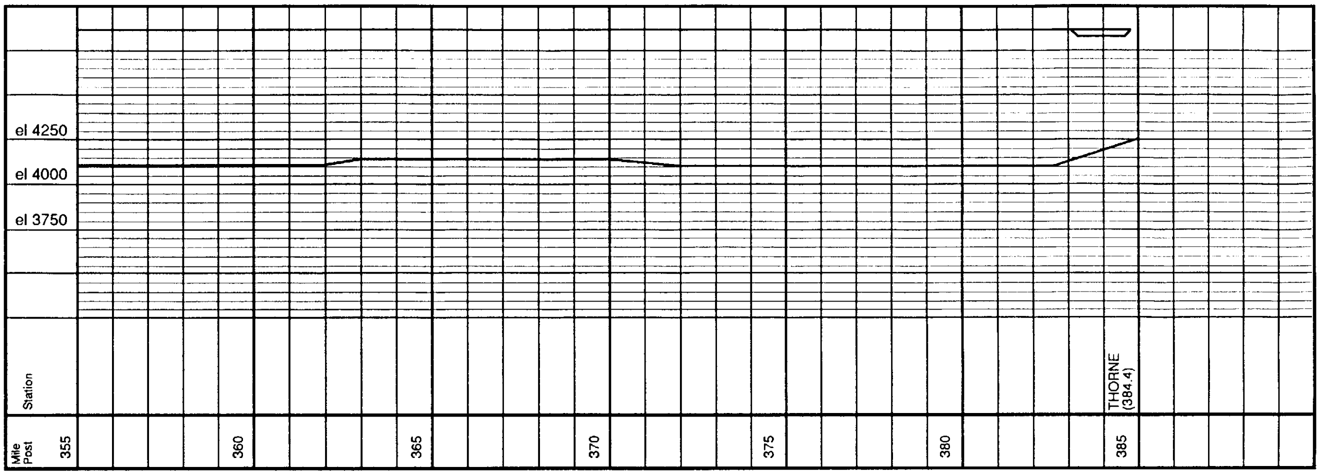
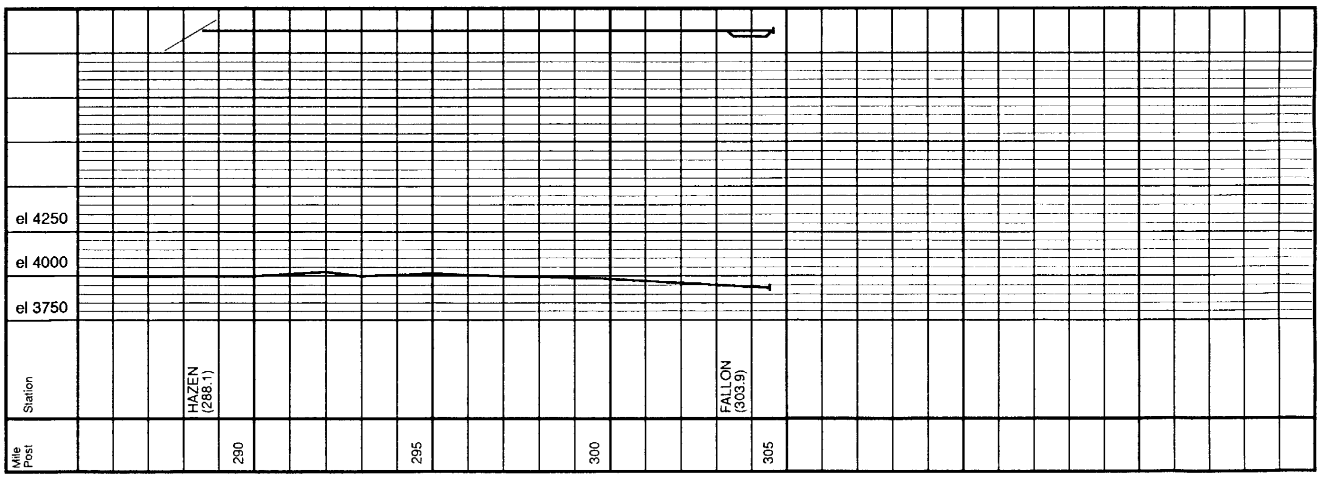
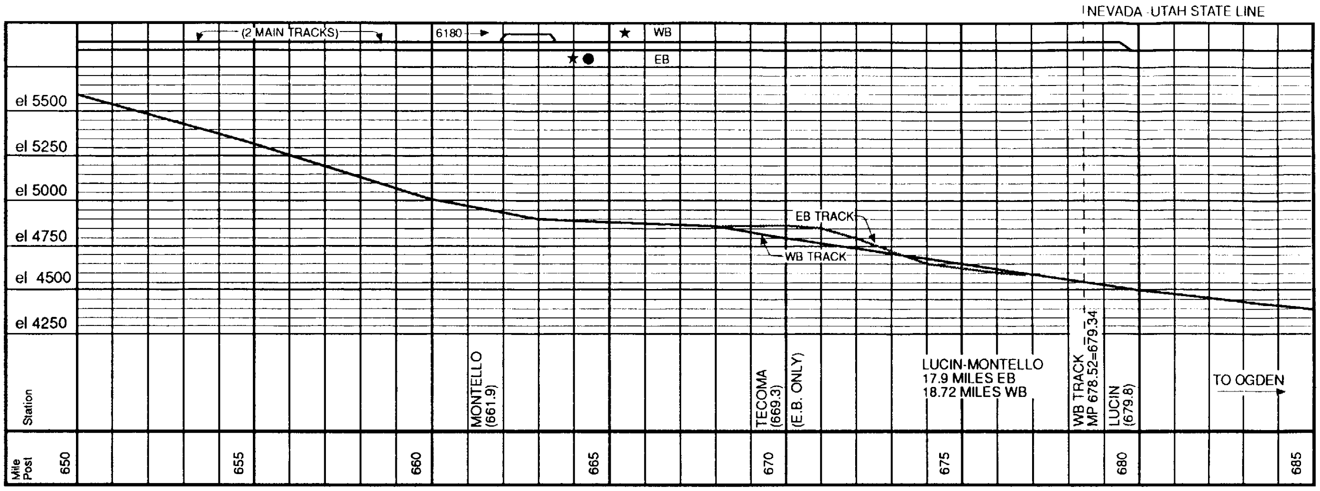


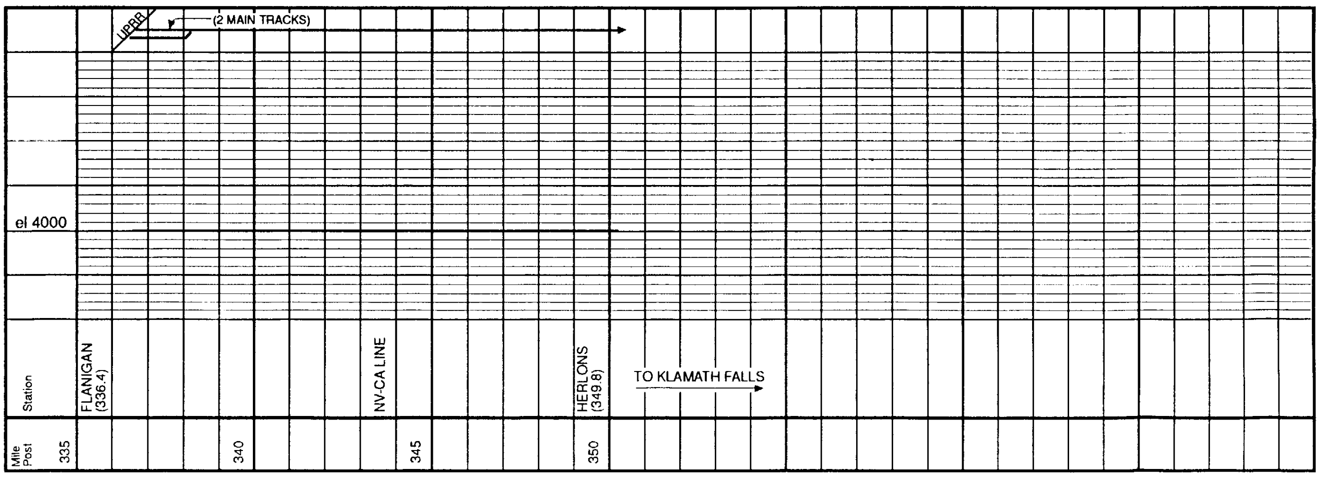
SOUTHERN PACIFIC - HAZEN-THORNE BRANCH



SOUTHERN PACIFIC - HAZEN-FALLON BRANCH



SOUTHERN PACIFIC -OVERLAND ROUTE



SOUTHERN PACIFIC - MODOC LINE

APPENDIX C
HAZARDOUS MATERIALS INCIDENTS IN NEVADA
1979-1990
AS REPORTED TO THE
HAZARDOUS MATERIALS INCIDENT SYSTEM

HMIS RAIL INCIDENTS IN NEVADA - 1979-1990

REPORT NO.	DATE	CARRIER*	LOCATION	SHIPPING NAME (as entered in HMIS)
79041267	4/03/79	UP	HENDERSON	AMMON PERCHLORA
79060334	4/17/79	WP	RAGLAN	PAINT ENAM LAQ
80051205	4/17/80	UP	LAS VEGAS	LPG
80091318	8/22/80	SP	SPARKS	SULFURIC ACID
80101040	9/16/80	SP	LOVELOCK	SULFURIC ACID
80120852	12/09/80	WP	ELKO	LPG
81030926	2/12/81	UP	BROWN	POISONOUS LIQ N
81070342	5/20/81	UP	CRESTLINE	LPG
81080630	8/01/81	SP	SPARKS	SULFURIC ACID
81120493	12/07/81	WP	ELBURZ	HYDROCHLORIC AC
82120136	11/30/82	MSC	HENDERSON	HYDROGEN SULFID
83060015	4/15/83	SP	SPARKS	PETROLEUM NAPTH
83060180	5/19/83	SP	COSGROVE	POISONOUS LIQ N
84060549	5/21/84	UP	LAS VEGAS	CORR LIQ NOS
84090024	7/02/84	SP	MONTELLO	PHOSPHORUS WH/Y
85090118	8/21/85	SP	MOSEL	SULFURIC ACID
85110176	10/28/85	UP	HENDERSON	HYDROCHLORIC AC
86010436	1/13/86	SP	SPARKS	ALCOHOLIC BEVER
86010461	1/25/86	SP	SPARKS	SODIUM METH ALC
86040506	4/15/86	MSC	HENDERSON	HYDROGEN SULFID
86060566	5/28/86	SP	SPARKS	SULFURIC ACID
86080464	2/22/86	SP	CARLIN	SULFURIC ACID
86090230	8/20/86	SP	MILL CITY	ALCOHOLIC BEVER
87040175	12/01/86	UP	LAS VEGAS	CHLORINE
87110023	9/29/87	UP	LAS VEGAS	HYDROCHLORIC AC
87110024	9/29/87	UP	ARDEN	HYDROCHLORIC AC
88020299	12/13/87	SP	SPARKS	OIL NOS
88040227	3/08/88	UP	LAS VEGAS	PHOSPHORIC ACID
88070306	5/23/88	UP	LAS VEGAS	SULFURIC ACID
89020477	1/30/89	UP	LAS VEGAS	PHOSPHORIC ACID
90010123	4/12/89	UP	LAS VEGAS	SULFURIC ACID
90010145	5/16/89	UP	RENO	LPG
90010178	7/24/89	UP	LAS VEGAS	SULFURIC ACID
90010245	12/05/89	UP	LAS VEGAS	HYDROCHLORIC AC
90040639	2/18/90	UP	CALIENTE	HYDROCHLORIC AC

* NOTE: MSC = MONTANA SULPHUR & CHEMICAL COMPANY, UP = UNION PACIFIC, WP = WESTERN PACIFIC, SP = SOUTHERN PACIFIC

APPENDIX D
ACCIDENTS INVESTIGATED BY THE NATIONAL TRANSPORTATION SAFETY BOARD IN NEVADA, 1979-1989

APPENDIX D
ACCIDENTS INVESTIGATED BY THE NATIONAL TRANSPORTATION SAFETY BOARD IN NEVADA, 1979-1989

The 15 accidents investigated by the NTSB in Nevada for which reports were available are briefly summarized in the following sections.

1. Derailment, Southern Pacific Transportation Company, Deeth, NV, February 21, 1979

At approximately 1:20 AM, a westbound freight train departed Ogden, Utah, en route to Roseville, California. The train consisted of 3 diesel-electric locomotives, 57 loaded cars, 8 empty cars, and a caboose. The train weight was 6,509 tons, and it was 3,735 feet in length. The train was manned by an engineer and a head brakeman, who were riding in the cab of the lead locomotive, and a conductor and a rear brakeman, who were riding in the caboose.

At approximately 6:30 AM, the train was traveling about 45 miles per hour and was approaching the trailing switch for the Western Pacific Railroad (now the Union Pacific) crossover east of Deeth, Nevada, when the train's automatic airbrake activated itself. The train came to a stop approximately one-quarter of a mile west of the crossover. The engineer immediately notified the dispatcher and his conductor that some cars derailed just behind the locomotives. The crew's inspection of the train found that 38 cars had derailed, from the 4th through the 41st car behind the locomotives.

Investigation showed that the one of the wheels of the third car behind the locomotives was broken. This car came to rest approximately 1,400 feet west of the crossover, and the following 38 cars derailed at the crossover.

Estimated damages were:

Equipment	$ 812,000
Clearing	60,000
Southern Pacific track	125,000
Western Pacific track	25,000
Lading	500,000
Total	$1,522,000

There were no injuries, fatalities, fires, or explosions.

2. Derailment, Southern Pacific Transportation Company, Schurz, NV, October 31, 1979

On October 31, 1979, a westbound freight train departed Mina, Nevada, bound for Sparks, Nevada. The train consisted of 2 locomotives, 18 loaded cars, 5 empty cars, and a caboose. The train weight was 2,266 tons, and it was 1,150 feet long. The train was manned by an engineer and head brakeman, who were riding in the cab of the lead locomotive, and a conductor and rear brakeman, who were riding in the caboose. At approximately 5:15 PM, near MP 366.0, the train's automatic emergency brake was applied. The train was traveling at a speed of approximately 20 miles per hour. The crew's investigation of the situation revealed that 13 cars had derailed.

Investigation by the carrier revealed that a four-foot section of the ball of the south rail had broken under the train. The examination of the rail showed that a vertical split head defect, four feet in length, existed before the accident. A vertical split head defect is a progressive longitudinal fracture in the head of the rail, where separation along a seam spreads vertically through the head at or near the middle of the head. The appearance of the defect in the rail will show a dark streak on the running surface, and a widening of the rail head for the length of the split. The track had been visually inspected two days before the accident and had been inspected ultrasonically approximately 2 1/2 months earlier. During this inspection, a 12-inch and an 8-foot vertical split head were found at MP 365.97 and 366.15. Both of these defective rails had been changed the same day that they were discovered.

Estimated damages were:

Equipment	$343,000
Track	20,000
Clearing	1,000
Lading	27,600
Total	$391,600

There were no injuries, fatalities, fires, or explosions.

3. Derailment, Southern Pacific Transportation Company, Massie, NV, November 5, 1979

On November 5, 1979, an eastbound freight train departed Sparks, Nevada, at about 10:00 PM en route to Ogden, Utah. The train was manned by an engineer and head brakeman, who were riding in the cab of the lead locomotive, and a conductor and rear brakeman, who were riding in the caboose. The train consisted of 3 locomotives, 33 loaded cars, 128 empty cars, and a caboose. At approximately 11:15 PM, at MP 293.3 near Massie, Nevada, and at the east switch of a long siding, the train's automatic airbrake system activated. The crew's inspection found that 45 cars had derailed, from the 10th through 54th cars behind the locomotives. Wheel marks on the south rail and on the crossties of the main track place the initial point of derailment at MP 291.6, approximately 1.7 miles west of the general derailment site. The train was traveling at a speed at approximately 45 miles per hour at the time of the accident.

Investigation revealed that a wheel on the 13th car behind the locomotives had broken.

Estimated damages were:

Equipment	$1,120,500
Track	110,000
Lading	64,000
Clearing	10,500
Total	$1,305,000

There were no injuries, fatalities, fires, or explosions.

4. Derailment, on Western Pacific Railroad track, Sano, Nevada, January 28, 1980

On January 27, 1980, a westbound freight train operated by the Southern Pacific Transportation Company departed Carlin Yard at Carlin, Nevada, at about 7:30 PM. The train consisted of 2 locomotives, 18 loaded cars, 38 empty cars, and a caboose. The train's trailing tonnage was 2,541 tons, and it was 3,222 feet in length. The train was manned by an engineer and a head brakeman, who were riding in the lead locomotive, and a conductor and a rear brakeman, who were riding in the caboose. The engineer made several stops en route to set out cars and advised that the trip was normal. He stated that just prior to MP 405.0 he was operating the train at about 50 miles per hour. He increased the throttle to speed up to 55 miles per hour. At MP 397.8, the engineer decreased the throttle as required by operating rules. After the throttle change, the train traveled for a few moments and then the lead locomotive derailed. The derailed locomotive traveled approximately 1,000 feet before it came to a stop. No one was injured. Inspection by the crew showed that the two locomotives and 19 cars had derailed.

Investigation revealed that the accident was caused by an instability in the front truck of the lead locomotive that was aggravated by the rapid deceleration.

Estimated damages were:

Equipment	$283,000
Lading	202,000
Track	104,000
Clearing	37,000
Total	$626,000

There were no injuries, fatalities, fires, or explosions.

5. Derailment, Southern Pacific Transportation Company, Winnemucca, NV, April 12, 1980

On April 12, 1980, a westbound Southern Pacific freight train departed Carlin, Nevada, bound for Roseville, California. The train consisted of 3 locomotives, 32 loaded cars, 107 empty cars, and a caboose. The train received a pre-departure airbrake test and inspection, and no discrepancies were noted. It was manned by an engineer and a head brakeman, who were riding in the lead locomotive, and a conductor and a rear brakeman, who were riding in the caboose.

At approximately MP 422.4, the engineer and brakeman observed a clear block signal on the approach signal for the interlocking plant at Weso, Nevada. The interlocking plant is the point at which paired track operation begins for trains moving eastward and ends for trains moving westward. The train continued moving past the signal. As the train came around a curve, a stop signal was observed on the home signal for Weso interlocking. The signal was located about 3/4 of a mile ahead of the train, and the train was travelling about 40 miles per hour. The engineer immediately applied the service brake and lowered the throttle to idle position. At this time, the engineer felt a heavy surge on the locomotive from the rear of the train, and the train's automatic airbrake system went into an emergency stop application. An inspection of the train by the crews found that 29 cars had derailed, from the 30th through the 58th car behind the locomotives.

Investigation revealed that the dispatcher handling the passage of trains through the interlocking plant had properly coded the signal for passage of the westbound train. However, moments later the dispatcher received a request for passage by an eastbound train and improperly set the signals.

Estimated damages were:

Equipment	$553,000
Track	20,000
Clearing	10,000
Total	$583,000

There were no injuries, fatalities, fires, or explosions.

6. Derailment, Southern Pacific Transportation Company, Barth, Nevada, June 9, 1980

At 7:20 AM on June 9, 1980, an eastbound Southern Pacific freight train departed Sparks, Nevada, en route to Ogden, Utah. The train consisted of 3 locomotives, 113 empty cars, and a caboose. The train's trailing weight was 4,137 tons, and it was 3,735 feet long. The train was manned by an engineer, a fireman, and a head brakeman, who were riding in the cab of the lead locomotive, and a conductor and a rear brakeman, who were riding in the caboose.

The fireman was operating the train at about 2:40 PM at about 40 miles per hour near Barth, Nevada (MP 629.3). The train was traversing a left-hand curve through a hill-cut when the fireman observed a kink in the track alignment about 150 feet ahead of the locomotive. The fireman stated that the kink in the track was about 6 inches to the south (the high rail on the curve) and was about 12 feet in length. When the lead locomotive struck the irregularity, the crew members were jarred from their seats, but the locomotive did not derail. The fireman immediately notified the crew members in the caboose of the situation and advised them to brace themselves. The fireman then applied the service brakes and began lowering the throttle. Suddenly the train's automatic airbrake system activated and the train came to a stop at MP 630.4. When the emergency brakes applied, the train had already slowed to about 30 miles per hour. Upon inspection by the crew, it was discovered that the 53rd car behind the locomotive had derailed, the next seven cars had not derailed, and the next 25 cars were derailed within the hill-cut area at MP 629.3. The remaining rear cars and the caboose were not derailed.

Inspection of the track just west of the accident site disclosed variations in gage. On June 6 and 7, 1980, the curved track had been raised, tamped, and lined. The work was classified as general maintenance. An inspection of a portion of the tamped track showed that no new ballast was used and, due to the muddy condition of the ballast, the tamper feet left open holes in the crib of the ballast. The drainage ditch through the hill-cut was full of rock debris and mud.

Estimated damages were:

Equipment	$810,000
Clearing	50,000
Track	20,000
Total	$880,000

There were no injuries, fatalities, fires, or explosions.

7. Derailment, Union Pacific Railroad Company, Islen, Nevada, July 16, 1980

A westbound freight train departed Milford, Utah, at 11:00 PM on July 15, 1980. The train consisted of 4 locomotives, 87 loaded cars, 3 empty cars, and a caboose. The train received an initial airbrake test and inspection prior to leaving, and no discrepancies were noted. It was manned by an engineer and a head brakeman, who were riding in the lead locomotive, and a conductor and a rear brakeman, who were riding in the caboose. At approximately 2:20 AM, near MP 478.0, the train went into an automatic emergency brake application and stopped. Inspection by the train crew revealed that the train had separated and 14 cars had derailed. The derailed cars were the 58th through the 71st cars behind the locomotive. At the time of derailment, the train was traveling 25 miles per hour.

No cause of this accident was identified. The car that initially derailed was a covered hopper designed for sanitary and economical bulk shipment of dry, granular, or powdered commodities. On July 14, 1980, the car had been loaded with bulk flour and had a gross weight of 95,060 pounds. The inspection of this car after the derailment found no discrepancies in the condition of the car, nor in the distribution of the load. The inspection of the track east of the initial point of derailment found no deviation from the track profile or alignment. Track bed, rails, and cars all checked out normally.

Estimated damages were:

Equipment	$123,000
Track/Signal	275,000
Clearing	106,000
Lading	26,000
Total	$530,000

There were no injuries, fatalities, fires, or explosions.

8. Derailment and collision, Union Pacific Railroad, Islen, Nevada, March 26, 1981

At approximately 9:45 PM on March 26, 1981, a westbound Union Pacific unit coal train was moving at a speed of 8 miles per hour on a siding at Islen, Nevada. The train was traversing a 10° 6' right-hand curve and moving down a 0.77 percent grade at the time. The engineer was using dynamic braking (braking with the train's electric motors) and preparing to stop. The engineer applied the automatic brakes to stop and moments later the train's automatic air brakes made an emergency stop application. Inspection revealed that the 32nd car and 13 cars after it had derailed. Investigation revealed that the application of dynamic braking on the descending curve had created enough lateral force to tip the south rail causing a jack-knife and derailment.

After the westbound train derailed, an eastbound train was moving on the main track, next to the siding, at a speed of about 20 miles per hour traversing a left-hand 10° turn. The lead locomotive of the eastbound train struck one of the derailed cars of the westbound train, and it derailed and turned over on its side. The two following locomotives derailed but stayed upright on the track structure.

Five employees were injured during the collision. Three of the injured employees were deadheading to their home terminal in the caboose of the eastbound train; the other two employees were part of the working crew of the eastbound train.

Estimated damages were:

Equipment	$558,763
Track	45,925
Clearing	25,000
Lading	24,000
Signals	525
Total	$654,213

There were no fatalities, fires, or explosions.

9. Derailment, National Railroad Passenger Corporation, Kyle, Nevada, June 6, 1981

On June 6, 1981, at approximately 10:40 PM, an eastbound Amtrak Train consisting of two locomotives and six coaches departed Las Vegas, Nevada, en route to Salt Lake City, Utah, on the Union Pacific Railroad Company tracks. It was manned by an engineer and a head brakeman, who were riding in the lead locomotive, and a conductor and a rear brakeman, who were riding in the rear coach. The passenger train was scheduled to meet a westbound train at Kyle, Nevada. The westbound freight train arrived at Kyle and stopped on the main track awaiting the arrival of the passenger train. The passenger train was to take the passing track and allow the long freight train to proceed westward. The Amtrak train moved onto the siding at approximately 10 miles per hour. The passenger train had traveled approximately 2,600 feet on the passing track and was moving at 5 miles per hour when the rear four coaches derailed. The engineer was not aware of the derailed passenger coaches until the train's automatic airbrake system activated.

The crew's inspection revealed that the 3rd through 6th car had derailed and stopped with all the wheels inside the rails of the passing track. The train had traveled about 500 feet before stopping, and one passenger coach was leaning against one of the freight cars on the main track. It was later determined that the 3rd car behind the locomotives was the first car to derail, and it spread the rails apart as it moved along, causing the cars behind it to derail.

There were 145 passengers on the four derailed coaches. The passengers were transferred to the two front coaches, and the train continued on to Caliente, Nevada, where the passengers were transferred to commercial buses for the trip to Salt Lake City.

Investigation revealed a defective track structure. At the point of derailment, there were six consecutive defective track ties, allowing the rail to spread and causing wide gauge.

Estimated damages were:

Equipment	$ 97,000
Track & Signals	20,000
Total	$117,000

There were no injuries, fatalities, fires, or explosions.

10. Derailment, Union Pacific Railroad Company, Dunphy, Nevada, May 28, 1984

At approximately noon on May 28, 1984, an eastbound Southern Pacific Transportation Company freight train was moving across a bridge over the Humboldt River at MP 610.96. The train was going approximately 45 miles per hour and was crewed by an engineer and a brakeman in the lead locomotive, and a brakeman and conductor in the rearmost caboose. The consist was made up of 4 locomotives, 74 loaded freight cars, and 3 cabooses. As the lead locomotive started onto the bridge, the engineer and brakeman both detected a slight lateral movement. The emergency airbrake automatically applied. A general derailment followed. At the time of the accident, the Humboldt River was flowing at record high levels with the water one foot below the rail. The average distance from the bottom of the rail to the water is 28 feet during normal flow. A local rancher had called the Union Pacific office the day before the accident and reported that water was flowing around the backside of the bridge and that the bridge might wash away. The dispatcher was unable to locate the proper inspector on the first attempt to have the bridge checked, and in the interim a train passed over the bridge and reported everything "OK." Seven additional trains passed over the bridge before the derailment.

The derailment resulted in 27 cars being destroyed and an additional three cars and two locomotives being damaged. The steel bridge and approximately 800 feet of track were destroyed.

Estimated damages were:

Equipment	$ 916,020
Lading	585,290
Track, Bridge, Sig.	440,000
Clearing	335,335
Total	$2,276,645

There were no injuries, fatalities, fires, or explosions.

11. Derailment, Union Pacific Railroad Company, Farrier, Nevada, August 19, 1984

On August 19, 1984, at approximately 4:45 PM, a westbound Union Pacific unit coal train was traveling at a speed of about 35 miles per hour approaching the east end of Farrier, Nevada. The train was made up of 5 locomotives, 111 loaded cars, and a caboose. It was manned by an engineer and a head brakeman, who were riding in the lead locomotive, and a conductor and a rear brakeman, who were riding in the caboose. At MP 393.75, the train rounded a bend and the engineer saw water and debris standing on the track ahead. The train's emergency brake-valve was placed in emergency stop position, and the train came to a stop. The crew's inspection of the accident site found that the last locomotive and the following 26 loaded coal cars had derailed.

Investigation revealed that at the time of the accident, it was hot and humid with moderate rain falling. Before the accident the area had been hit by a locally heavy rain storm, reportedly dropping five inches of rain in a two-hour period. The on-site inspection of the site revealed that rushing floodwaters had cut a gap into an earthen dike protecting the railroad on the north side. The gap became bigger as the flood waters rushed down the nearby hills and washed away a 600-foot section of the dike. The rushing waters deposited sand, rocks, and other debris on the track. Examination of the front of the locomotives indicated that the moving train had shoved some large boulders from the track structure.

Estimated damages were:

Equipment	$743,317
Lading	104,000
Track, Signals, Bridges, and Culverts	90,000
Clearing	40,000
Total	$977,317

There were no injuries, fatalities, fires, or explosions.

12. Rear-End Collision, Southern Pacific Transportation Company, Montello, Nevada, June 22, 1985

At about 2:15 AM on June 22, 1985, a Southern Pacific westbound freight train (designated Extra 8315 West) was standing on the track near Montello, Nevada. At the time of the accident, Extra 8315 consisted of 4 locomotives, 74 loaded covered hopper cars, 1 caboose, and a helper locomotive on the rear. It was manned by an engineer and a head brakeman, who were riding in the lead locomotive; a conductor and a rear brakeman, who were riding in the caboose, and an engineer and a fireman, who were riding in the helper locomotive. The train had stopped to allow the rear brakeman to make a walking inspection for a suspected hot wheel or sticking brake. All other crew members were in their respective positions.

As Extra 8315 was standing on the track, it was approached from the rear by Southern Pacific Extra 9169 West, a freight train consisting of 2 locomotives, 25 loaded freight cars, 56 empty freight cars, and a caboose. The train was manned by an engineer and a head brakeman, who were riding in the lead locomotive, and a conductor and a rear brakeman, who were riding in the caboose. The engineer of Extra 9169 stated that the train was travelling at 22 miles per hour. The engineer initiated a service application of the automatic train brakes followed immediately by an emergency application. The head brakeman jumped from Extra 9169 approximately 100 feet before the collision. All other crewmen stayed in their positions.

The lead locomotive of Extra 9169 struck the rear of the helper locomotive on Extra 8315 and the couplers between the two locomotives coupled on impact. The collisions moved the helper locomotive about 100 feet westward. The shank on the helper locomotive coupler joining it to the caboose broke, and the body of the caboose was lifted up from the track by the pilot of the helper locomotive. The helper locomotive continued westward, and the body of the caboose collided with and sheared off the operating compartment of the helper locomotive. The caboose and rear car on the standing train came to rest on their sides, to the north of the track. No other equipment derailed.

Initially, the engineer and brakeman on Extra 9169 stated that the last signal passed had been green. Later the head brakeman reported that he had been "inattentive to his duties" and had not seen the last signal. The engineer then said that the last signal had become obscured prior to the locomotive passing it by what later was discovered to be the brightly-lit headlight of the standing helper locomotive. Burning this rear facing headlight is a violation of Federal regulations and Southern Pacific operating rules. The engineer in Extra 9169 was not operating at restricted speed as would have been required if a grade signal became obscured. Trains operate between Ogden, Utah, and Carlin, Nevada, by authority of train orders, timetable instructions, operating rules, bulletins, and the signal indications of an Automatic Block Signal system. Southern Pacific rules do not require a train crew to use flags, fusees, or rail torpedoes to protect the rear of a standing train in automatic signal territory.

The conductor on the standing train and the engineer of the helper locomotive sustained serious injuries. The engineer of Extra 9169 sustained minor injuries. The fireman of the helper locomotive was catapulted out of her seat and was killed.

Extensive investigation revealed that the automatic signalling system and the brakes of Extra 9169 were working properly. A simulation using a test train of the same weight and configuration as Extra 9169 was run through the accident scenario at roughly the same speed that the engineer reported he was traveling. The test train stopped almost 300 feet short of the point of impact with Extra 8315. There was no event recorder on Extra 9169 at the time of the accident. Drug tests on all employees showed no drugs in anyone's system.

Estimated damages were:

Equipment	$391,500
Track	2,042
Lading	4,123
Clearing	13,835
Total	$411,500

There were no fires or explosions.

13. Derailment, Southern Pacific Transportation Company, Mill City, NV, August 20, 1986

On August 20, 1986, a westbound Southern Pacific freight train was proceeding at 38 miles per hour down a .31 percent grade near Mill City, Nevada. The train was made up of 2 locomotives, 50 loaded and 44 empty freight cars, and a caboose. It was manned by an engineer and a head brakeman, who were riding in the lead locomotive, and a conductor and a rear brakeman, who were riding in the caboose. The train had been inspected before leaving Ogden, Utah. No exceptions were noted.

The first indication the train crew had that there was a problem with their train was when the automatic airbrakes applied in emergency. As the engineer and head brakeman looked back, they observed their train derailing and fire spreading through the overturned cars. The 30th car behind the locomotives and the 23 cars behind that one derailed. The train contained two tank cars loaded with LPG and one tank car of ethanol. The 30th car that initiated the derailment was the first of the two LPG tank cars. The NTSB investigation states that both cars containing LPG derailed onto their sides and lay along the north side of the track. Also, the shell of the car carrying ethanol sustained a four-foot rupture during the derailment. The FRA accident/incident report states that only two cars carrying hazardous materials were involved in the accident. The 20,400 gallons of ethanol ignited and flowed along the south side of the track to a spot near the derailed LPG cars. The LPG cars did not release any product; however, flames burning around the overturned tank cars gave emergency personnel concerns. The LPG did not ignite. As a precaution, a nearby truck stop and two mobile homes were temporarily evacuated. The NTSB report states that approximately 100 people were evacuated. The FRA report estimates that 20 people were evacuated. During wreckage removal, a tank car carrying a non-regulated ammonia-based fertilizer was punctured and lost its entire load of 10,159 gallons.

An employee of the contracted wreckage removal company sustained second-degree burns when the bulldozer he was operating uncovered an unknown quantity of ethanol. The ethanol ignited and engulfed the bulldozer and operator in flames.

Investigation revealed that a wheel on one of the LPG tank cars had broken, leading to the derailment. The broken wheel met all standards and regulations; the wheel on the other end of the axle exceeded flange wear standards.

Estimated damages were:

Equipment	$549,500
Track	64,000
Lading	227,347
Clearing	28,700
Total	$869,547

There were no fatalities or explosions.

14. Hazardous Material Spill, Union Pacific Railroad Company, Las Vegas, NV, May 23, 1988

On May 19, 1988, the Union Pacific Railroad Company picked up a tank car containing approximately 13,000 gallons of sulfuric acid from the Kennecott Corporation in Garfield, Utah. After being moved between several consists, the car arrived in the Las Vegas yard at about 6:35 AM on May 24, 1988. At about 7:00 AM, the crew of a yard engine that was switching cars nearby noticed a faint odor and observed liquid oozing from the manway atop the tank car. The crew notified the manager of terminal operations of the condition by radio. The manager, after verifying the leak, notified the railroad mechanical department and hazardous materials emergency response personnel of the incident. He then had the car positioned beneath a four-inch water pipe stanchion, where the mechanical department began flooding the surface of the car with water.

At about 10:00 AM, the hazardous material chief of the Las Vegas Fire Department was notified of the incident. After a personal inspection, the chief determined that no emergency condition existed and did not order the fire department units to respond.

The source of the leak was determined to be a ruptured frangible disc in the vent valve. It was learned that the UP railroad has no formalized emergency response plan published. The Union Pacific has, however, maintained close liaison with local emergency agencies and has provided to these agencies extensive training regarding the handling of hazardous materials on the railroad and the mechanical construction of the involved equipment. They have also incorporated a simple and effective hazmat incident reporting structure with ascending degrees of responsibility to its officers.

15. Derailment, Union Pacific Railroad Company, Sloan, Nevada, September 22, 1988

On September 22, 1988, at approximately 8:30 PM, the last 14 twin-stack cars of a Union Pacific westbound freight train derailed near Sloan, Nevada. The train consisted of 5 locomotives, pulling 26 twin-stack units, which is equivalent to 130 standard freight cars. The train was operated by a four-man crew. The engineer, the conductor, and one brakeman were in the lead locomotive. The other brakeman was in the second locomotive. None of the crew members was injured. One of two transients riding in the derailed cars was injured.

A small fire was caused when sparks from the undercarriage of the train ignited some damaged crossties. The local fire department quickly extinguished the blaze.

There were six 5-gallon containers of a hazardous material inside one of the commodities containers that were ruptured and some of their contents spilled. The spilled material was absorbed into the soil.

The inspection of the track revealed that all measurements were within FRA regulations, and no defects were found. The articulated connection assembly on one of the twin-stack cars revealed that the vertical pin was excessively tight and that the male connection was dry. The male connection showed coarse machine marks on the upper part of the pin. The twin-stack unit cars were on their initial run, having been newly manufactured in 1988.

Estimated damages were:

Equipment	$ 145,000
Lading	778,000
Track & Signals	74,483
Clearing & Transfer	75,000
Total	$1,072,483

There were no fatalities or explosions.